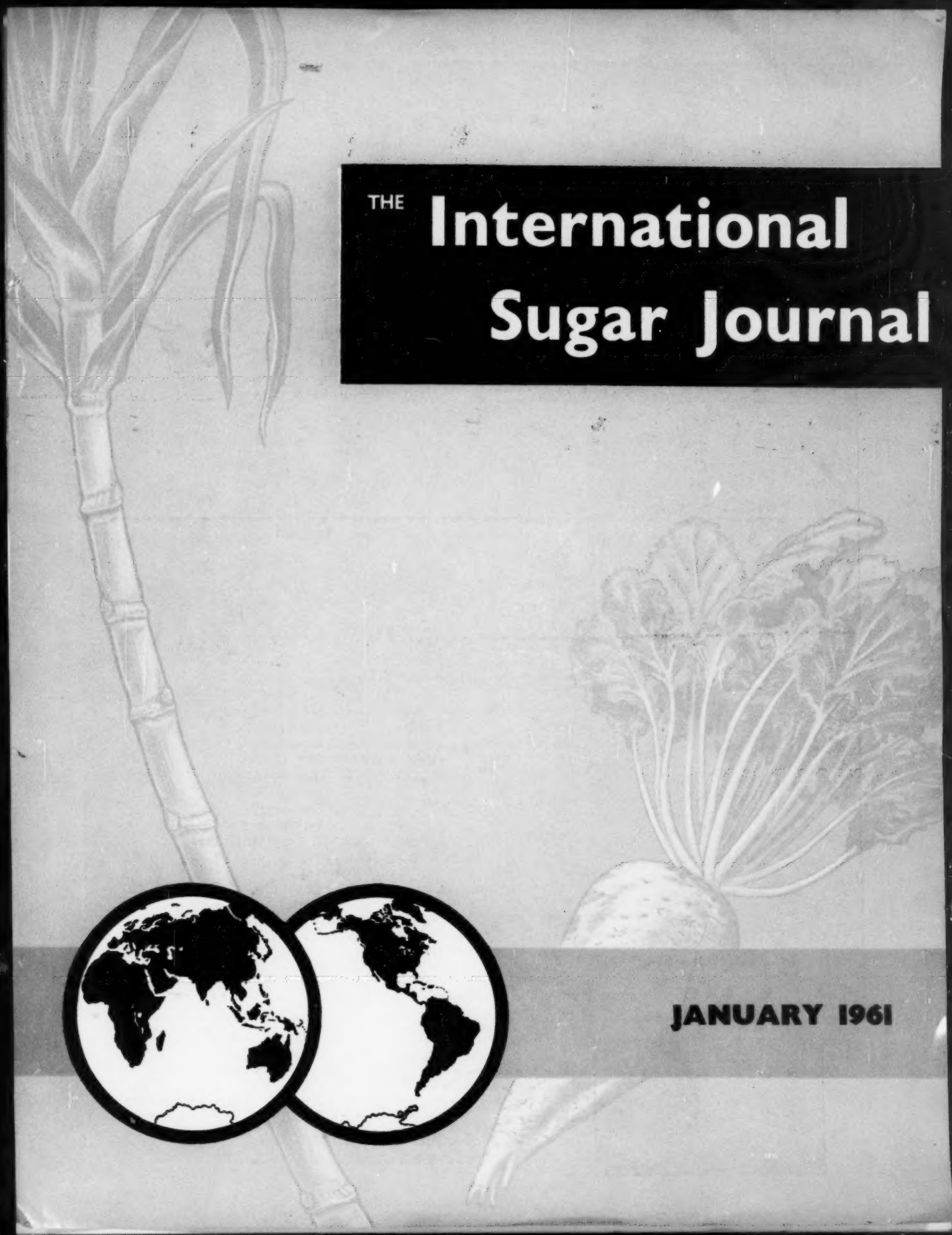


THE International Sugar Journal

JANUARY 1961

cane carrier and intermediate carrier

SLATS

Mirrlees Slats combine strength with [illegible] weight.

CANE CARRIER SLATS

Can be supplied, double or triple corrugated, black or galvanized, and will suit any 6 in. pitch chain and 8 in. pitch chains in the larger sizes. Where dimensions are given, [illegible] bolts or rivets.

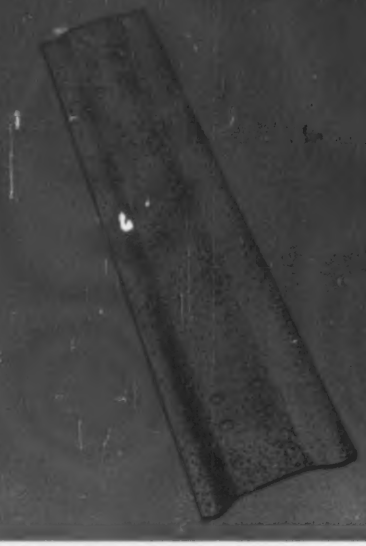
INTERMEDIATE CARRIER SLATS

Manufactured to designs to suit the 900 and the 5,600 series of Inter Carrier Chains. The overlap is close and slats can be supplied Black or Galvanized and holed for fixing if desired.

CHAIN & SPROCKET WHEELS

Mirrlees have exceptional experience in supplying cane and intermediate carrier chains for Sugar Mills. Full information on request.

Write for our Chains & Slats Brochure S131 – 58

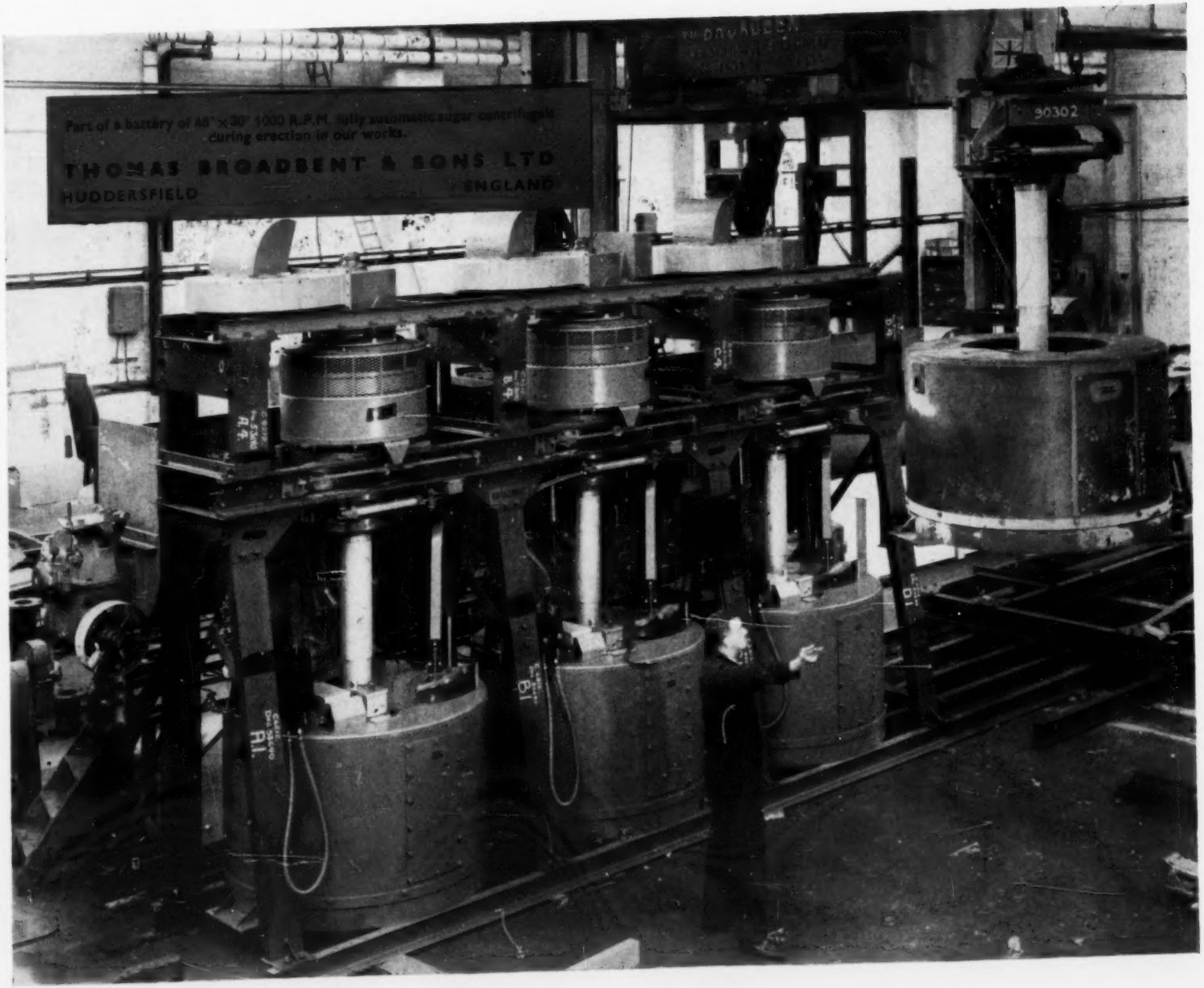


'Mirrlees'

THE MIRRLEES WATSON COMPANY LIMITED

Scotland Street, Glasgow, C.5.

38 Grosvenor Gardens, London, S.W.1.

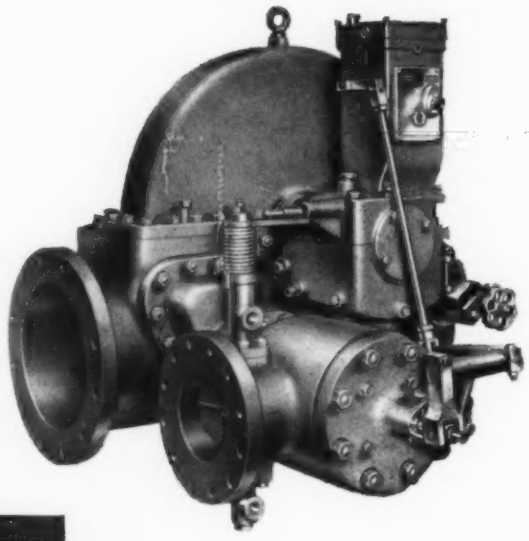

Part of a battery of 48" x 30" 1000 R.P.M. fully automatic sugar centrifugals during erection in our works.
THOMAS BROADBENT & SONS LTD
HUDDERSFIELD
ENGLAND
30302

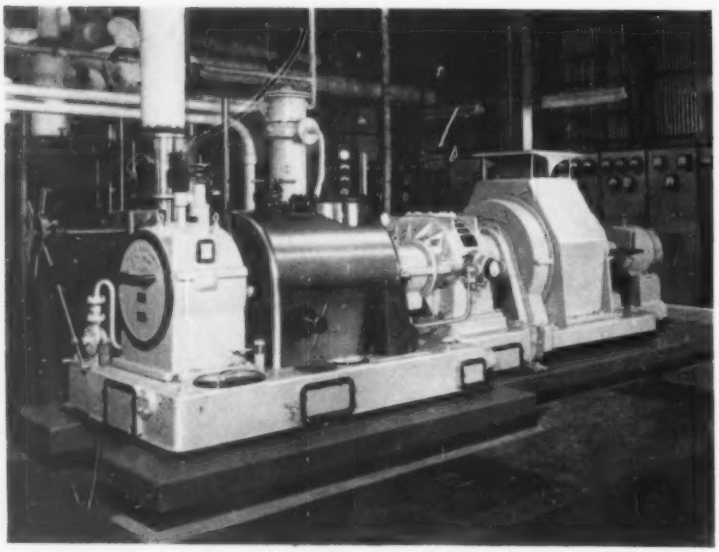
THE B & M SINGLE STAGE
SUGAR MILL TURBINE

Simple in design
Reliable and Economical
in Operation

25 to 1,200 h.p. direct coupled at speeds of up to 5,000 r.p.m. max. or supplied with reduction gearing of any desired ratio.

'B & M' single stage variable speed mechanical drive turbine, particularly adapted for SUGAR MILLS, PUMPS, etc.





750 kw back pressure turbine installed at Farleigh Sugar Mill, Queensland.

1,500 kw 'B & M' back pressure turbine and several steam engines also installed.

Many hundreds of 'B & M' Steam Turbines and Steam Engines have been supplied to the Sugar Industry for electrical and mechanical drives for:

CRUSHERS
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CANE KNIVES
PUMPS ETC.

Also **VACUUM PUMPS** Reciprocating and Rotary types.
'ARCA' Pressure and Temperature REGULATORS

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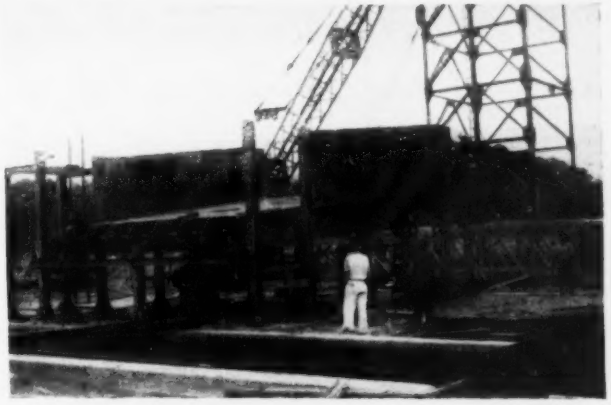
BIRMINGHAM 16 · ENGLAND

Even Feed...

. . . This first essential for good extraction is readily secured by the Mirrlees Feeding Table with levelling kickers.

The illustration shows an installation at a South American factory built and equipped by Mirrlees; the lower photograph was taken during construction. The Unloading Crane was also supplied by Mirrlees.



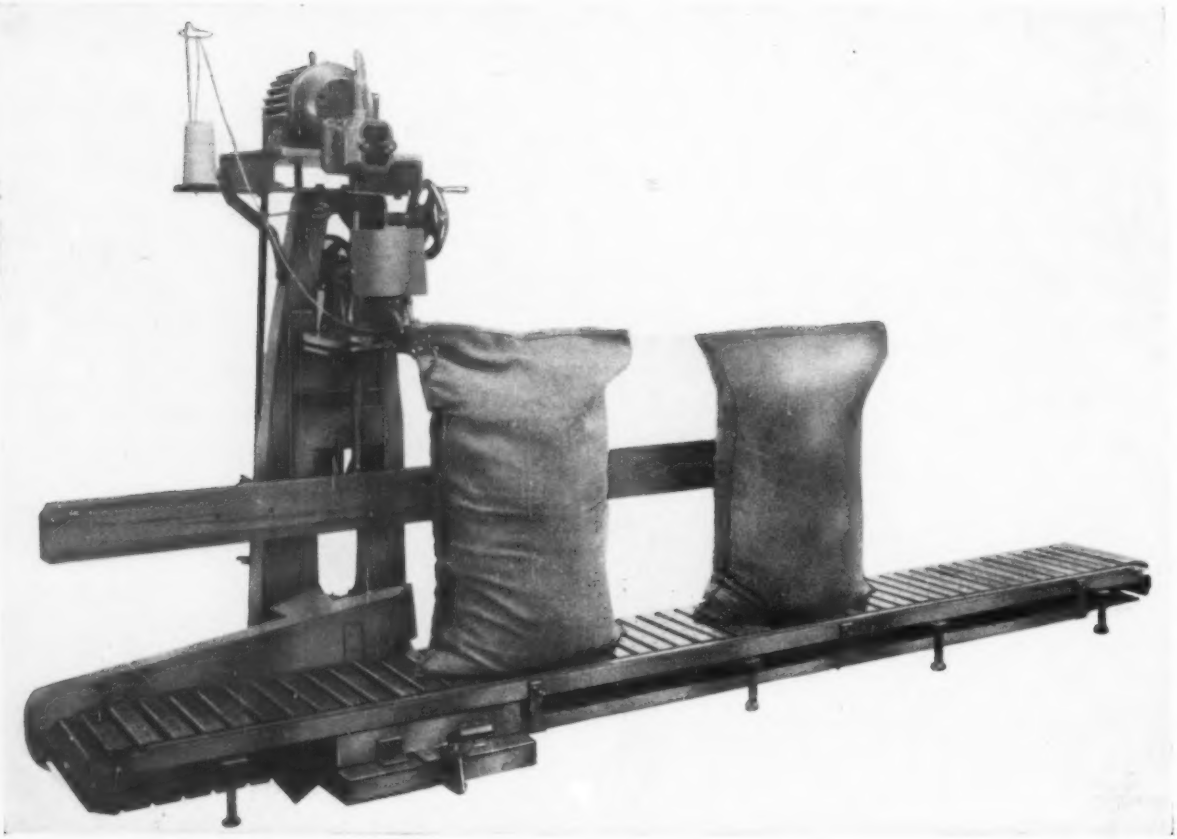
THE
MIRRLEES WATSON COMPANY LIMITED

Head Office and Works :
Scotland Street, Glasgow, C.5, Scotland
London Office : 38 Grosvenor Gdns., S.W.1

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

TIMEWELL WORKS · LOCKFIELD AVENUE · BRIMSDOWN · ENFIELD . MIDDX.

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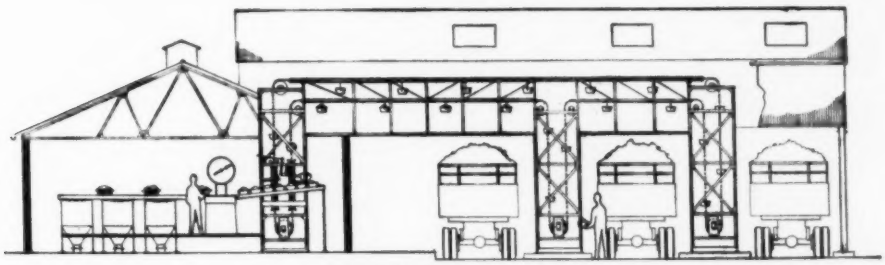
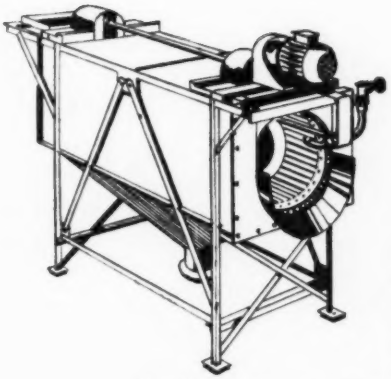
TAREHOUSE EQUIPMENT

AS SUPPLIED TO THE BRITISH & EIRE SUGAR CORPORATIONS AND TO MANY OF THE SUGAR BEET SEED GROWERS



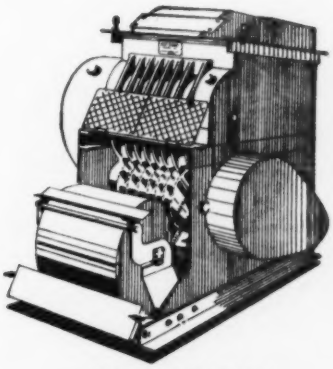
SAMPLES CONVEYOR

Combining regulated feed of samples direct from lorry, and safety by elimination of road crossing by the operators



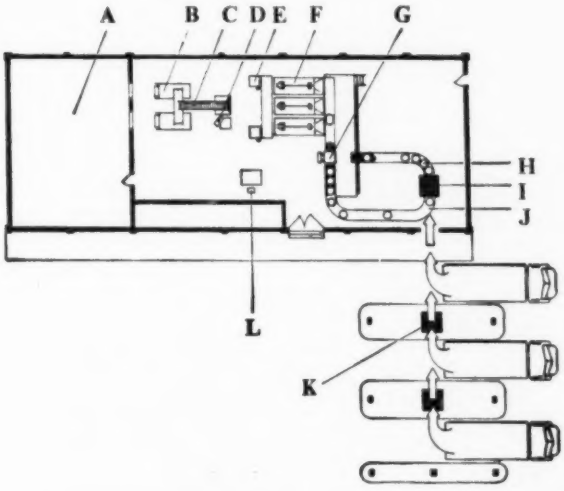
SPRAY WASHER

Using water at 90 lb. p.s.i. ensures clean roots
20 samples each of 50 lbs. handled per hour.
Speed of drum easily variable between 3 and 22 r.p.m. to suit type and quantity of dirt adhering to sample roots.



MULTIPLE SAW

Takes up to 100 lbs. of roots, handling a 30 lb. sample in 25 secs. and producing a representative sample of brei.



A TAREHOUSE LAYOUT

– *handling 650 samples per day.*

- **A** *Laboratory*
- **B** *Multiple Saw*
- **C** *Elevator*
- **D** *Scales (Clean)*
- **E** *Topping Tables*
- **F** *Spray Washer*
- **G** *Scales (Dirty)*
- **H** *Empty Pannikins*
- **I** *Unloading Leg of Samples Conveyor*
- **J** *Full Pannikins*
- **K** *Loading Leg of Samples Conveyor*
- **L** *Recorder*

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IPSWICH ENGLAND

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OA/6681

And—puns apart!—it undoubtedly will do, for it's made by David Brown. This particular spur gear is for a sugar mill, and has 132 teeth, is 24 inches face width, and 1 D.P. Of course, David Brown can make them a lot bigger than that! The checking of the keyway is just one of the tests made at many stages in the production of David Brown gears. That's one of the reasons why they run so sweetly, so long!

DAVID BROWN

100 YEARS 1860-1960

THE DAVID BROWN CORPORATION (SALES) LIMITED

JACKSON DIVISION · SALFORD WORKS · HAMPSON STREET · MANCHESTER 5 Telephone: Blackfriars 3577 (4 lines)

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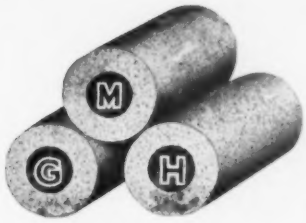
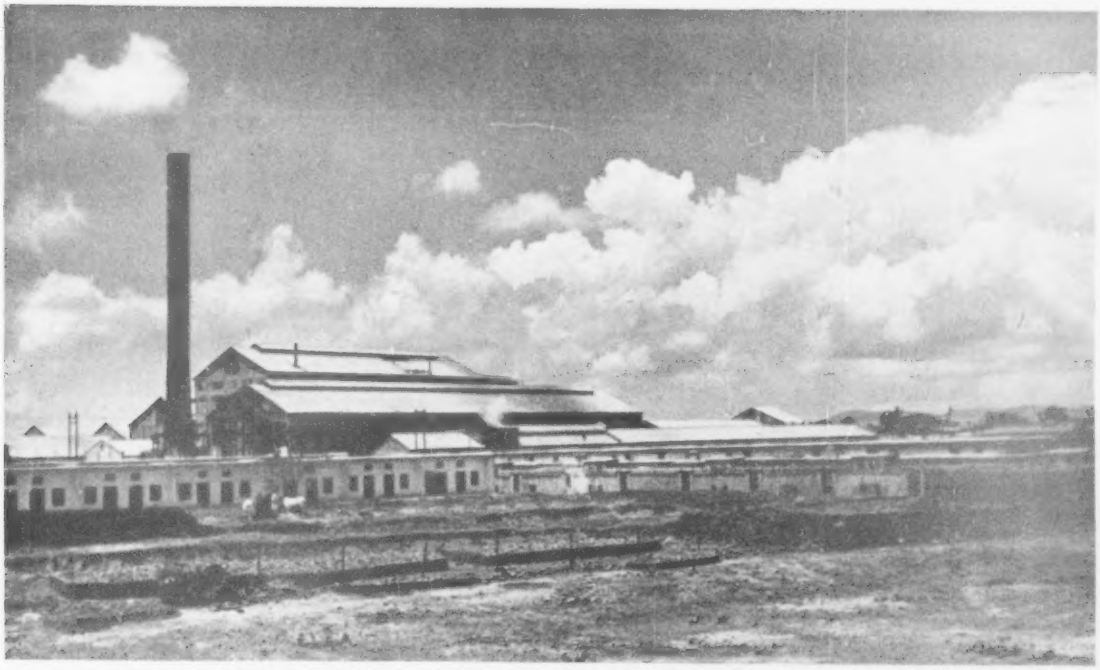
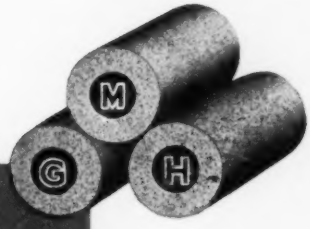
HAY





Sugar-Mill Rollers



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& MINIMUM WEAR

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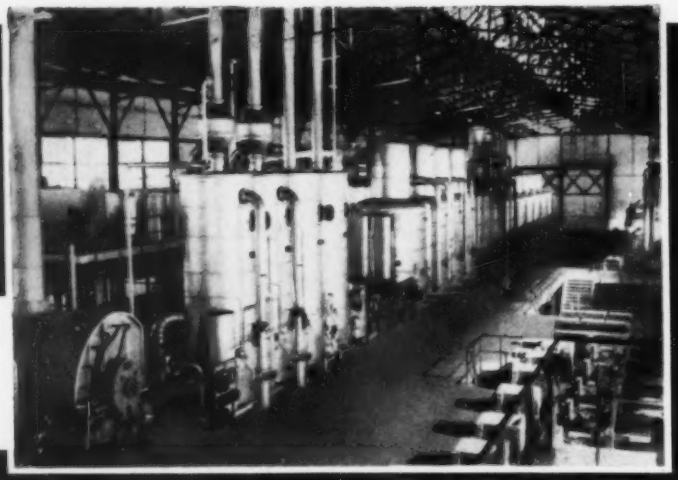
Ironfounders, GLASGOW

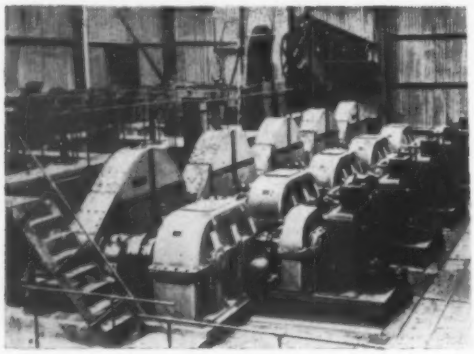


WE

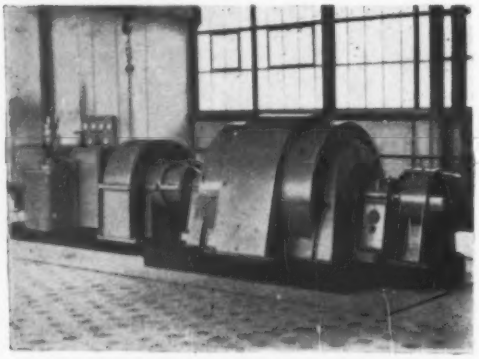
can supply everything for your cane or beet

SUGAR FACTORY

Set of five 26'' x 36'' mills.
Urena sugar factory (Venezuela)



1800 kW turbo-alternator.
Malatya sugar factory (Turkey)



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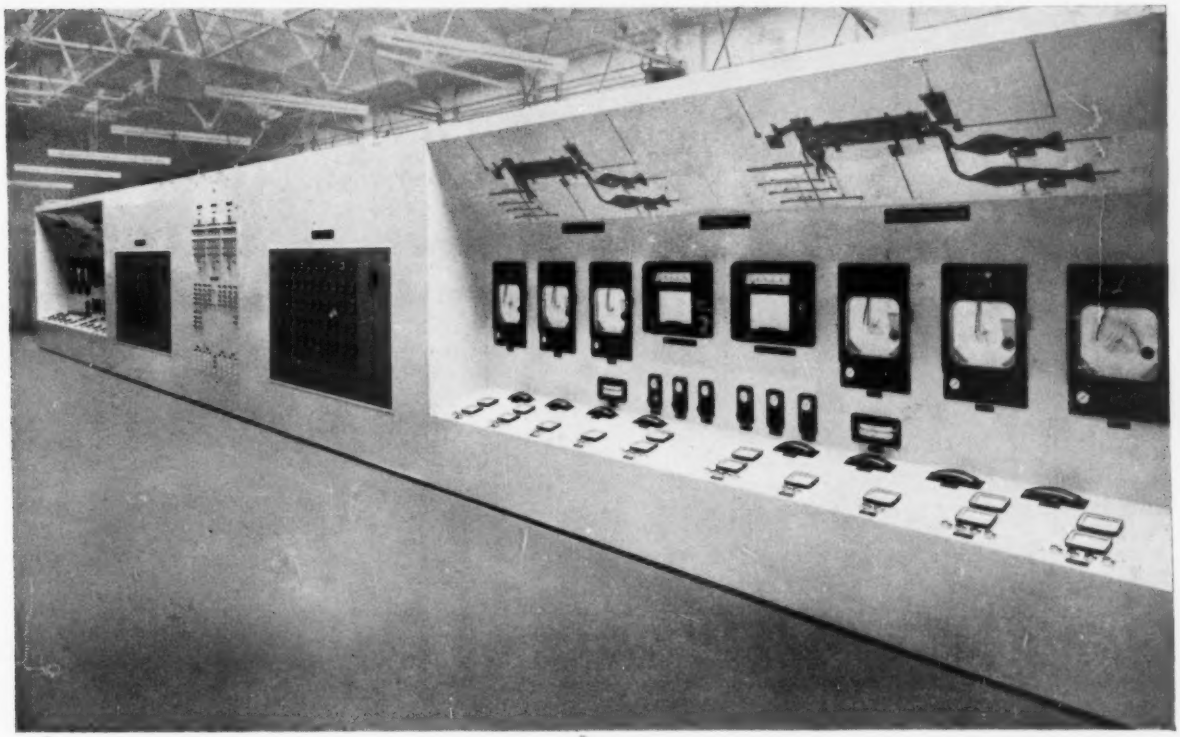
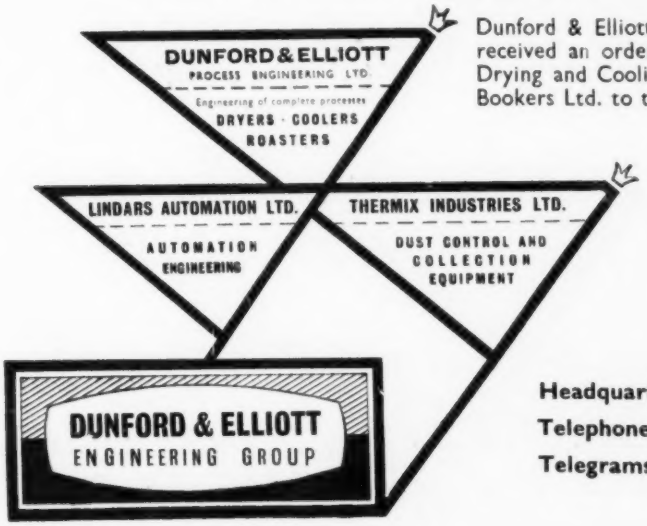
TATE & LYLE
Choose ROTARY LOUVRE

One of Dunford & Elliott's latest and largest achievements for sugar refineries is the installation of four completely automatic Rotary Louvre Dryers and ancillary equipment at the THAMES REFINERY of TATE & LYLE LTD.—believed to be the biggest refinery in the world.



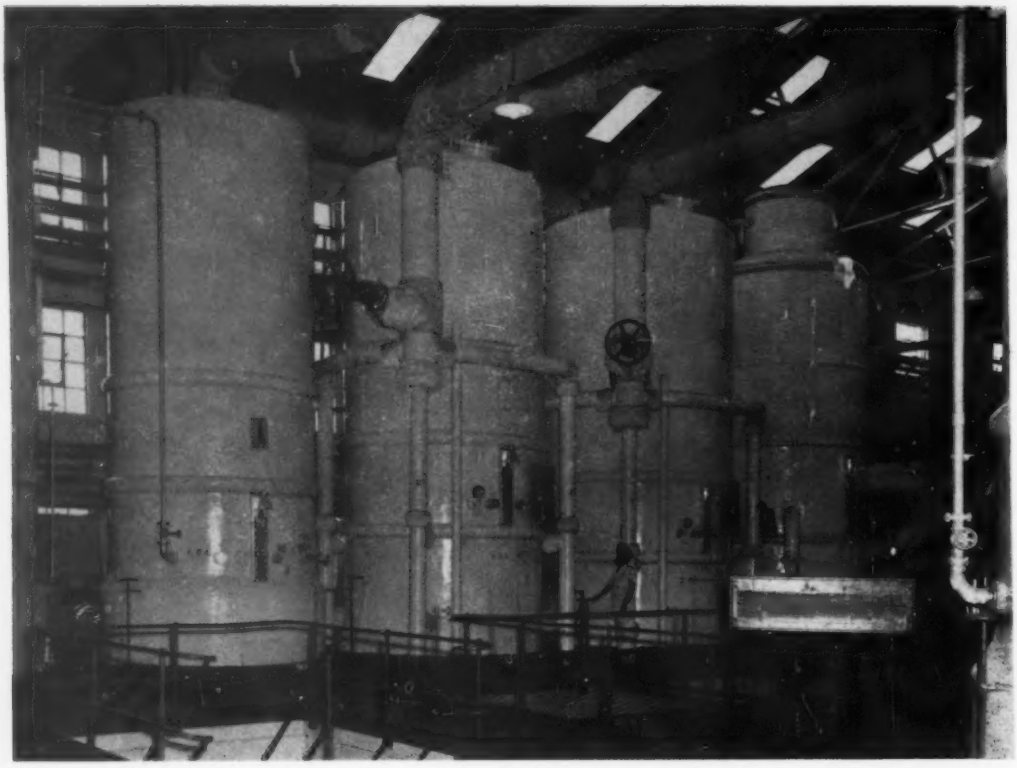
Control panel for Rotary Louvre sugar drying installation at the new Tate & Lyle Thames Refinery, designed and supplied by Dunford & Elliott. Photo by courtesy of Tate & Lyle Ltd.



Dunford & Elliott are also proud to announce having received an order to supply *Rotary Louvre* Sugar Drying and Cooling installations through Messrs. Vickers & Bookers Ltd. to two factories in the U.S.S.R.

Rotary Louvre Dryers and Coolers are used in leading industries throughout the world—as well as in the sugar industry—and frequently form part of such giant industrial projects as *Durgapur* in India.

Headquarters: 143 Maple Road, Surbiton, Surrey
Telephone: Kingston 7799
Telegrams: Lindaresco, Telex, London.



Evaporators at the British Sugar Corporation Beet Sugar Factory at Cupar fitted with H & W 70/30 Brass Tubes. The evaporators are lagged with plastic lagging. (Photograph by courtesy of the British Sugar Corporation Limited).

H&W

BRASS TUBES

for

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EVAPORATORS

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for quality uniformity and dependability

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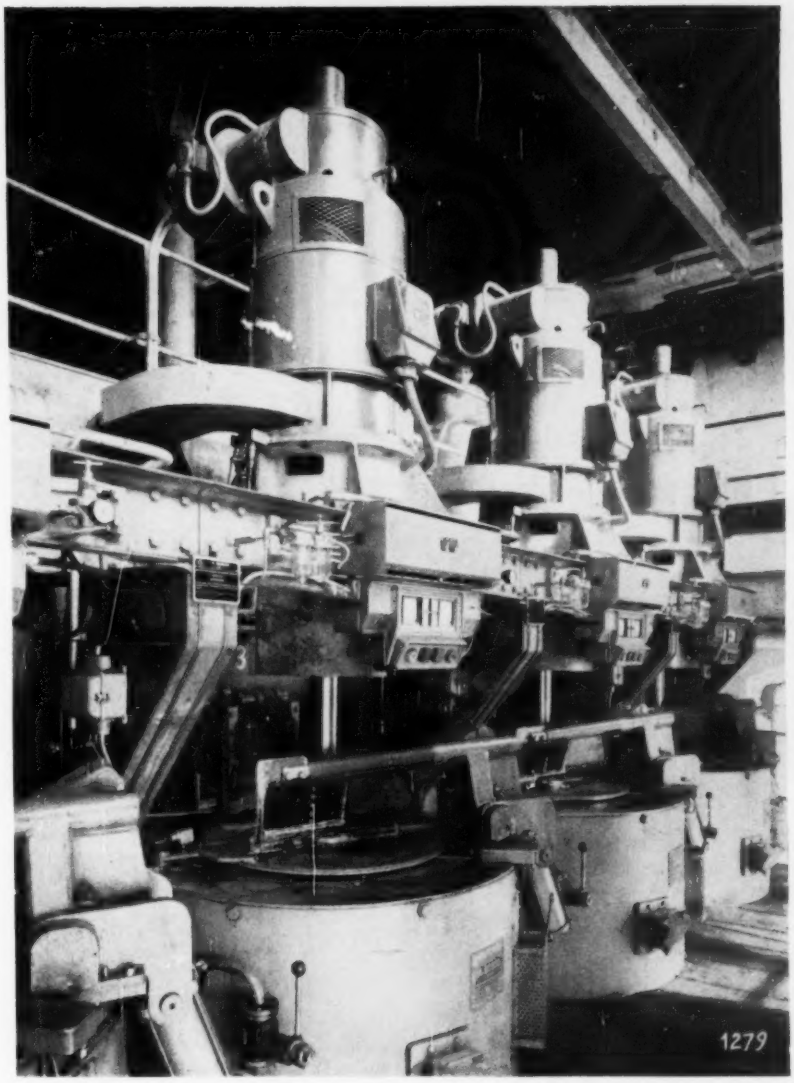
50, WELLINGTON STREET, GLASGOW, C.2.

Since it was established in 1890, our Company has manufactured machinery for the sugar industry, and for more than forty years has specialized in constructing centrifugals.

Our Technical Service is continually developing machines which incorporate improvements designed to meet the technological requirements of new and varying processes in the sugar industry, taking into account the demands of the European Common Market. These new centrifugals are distinguished for their high grade of *standardization* and for their low cost both from the point of view of the purchase price and running costs.



FULLY AUTOMATIC SUGAR CENTRIFUGALS

Type	*Basket D × H*	*Basket cross section*	*Massecuite Max. Charge*	*Performances*		
				Mod.	*Max. sp. r.p.m.*	*Cycles per hr.*
"SCARA. U"	1250 × 830 mm.	Cylindrical with truncated cone shaped bottom	500 kg.	Normal	1000	30
				Velox	1500	25
"SCAME. P"	1050 × 585 mm.	Cylindrical with flat bottom	350 kg	Normal	1500	20
				Velox	1800	10
"SCAME. G"	1220 × 762 mm.	Cylindrical with flat bottom	650 kg.	Normal	1000	25
				Velox	1500	20

BOSCO TERNI

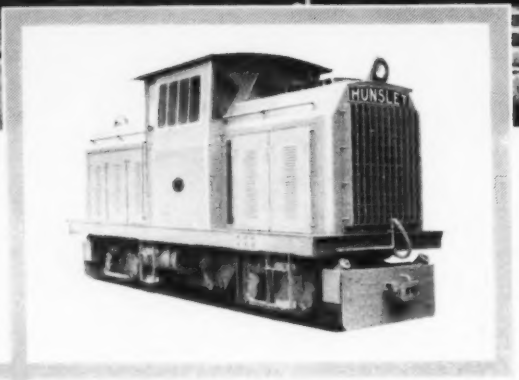
Officine Meccaniche e Fonderie

A. BOSCO

TERNI **ITALY**

SERVING THE SUGAR INDUSTRY

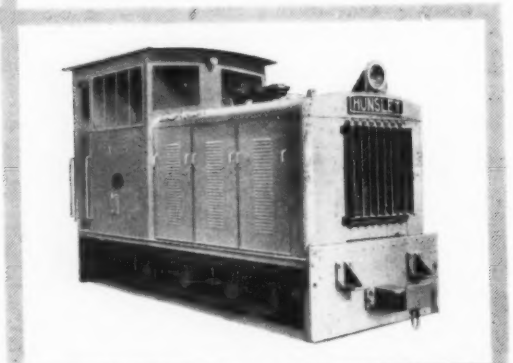
A fleet of Hunslet 204 h.p. 0-6-0 type diesel locomotives on heavy sugar cane haulage duties on a sugar estate in the West Indies.



230 h.p. 'Articulated' diesel locomotive.

HUNSLET

101 h.p. 0-6-0 type diesel locomotive



On estates and plantations all over the world Hunslet locomotives are in daily use, maintaining their reputation for absolute reliability and efficiency. This reputation is based on the skill and care which tends every stage of construction in the Hunslet works and in addition all Hunslet locomotives, wherever they may be serving, are backed by a comprehensive spares and service scheme.

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ONE OF THE HUNSLET GROUP OF COMPANIES

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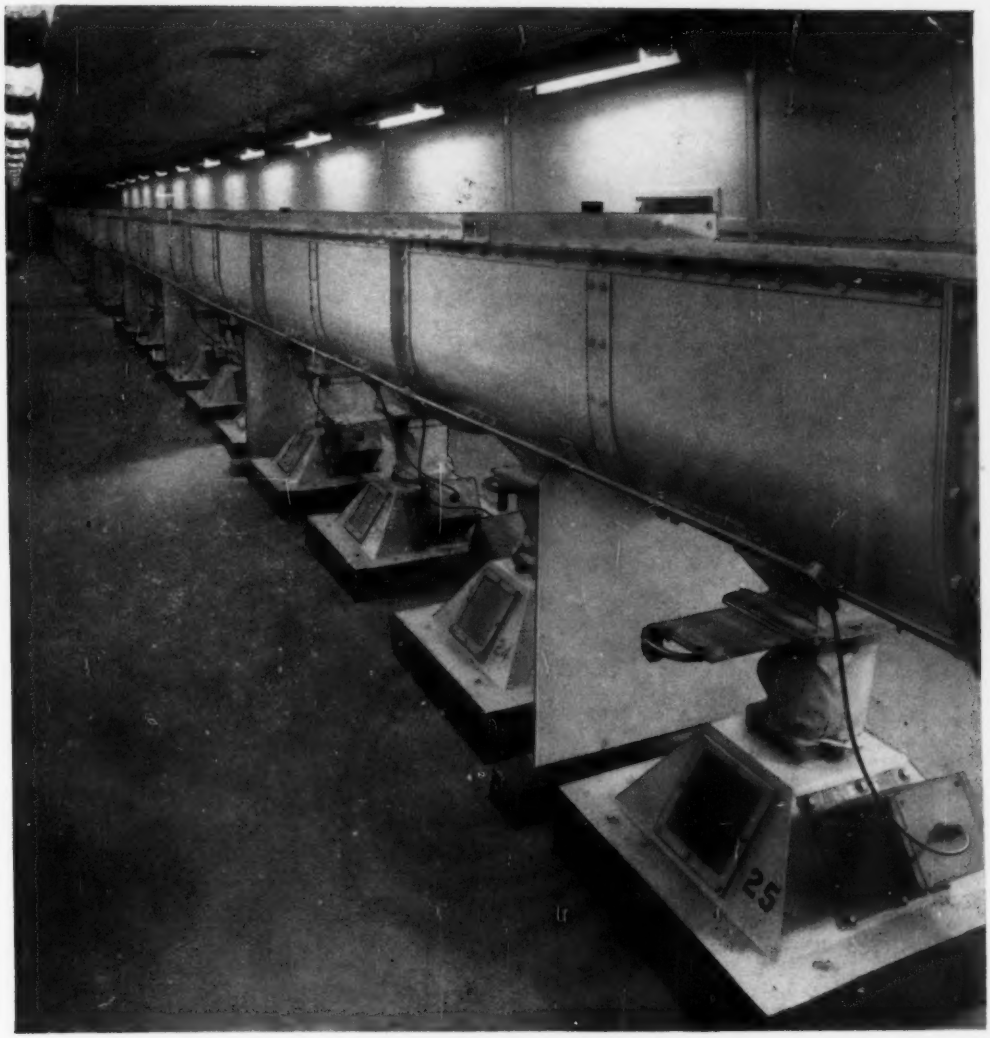

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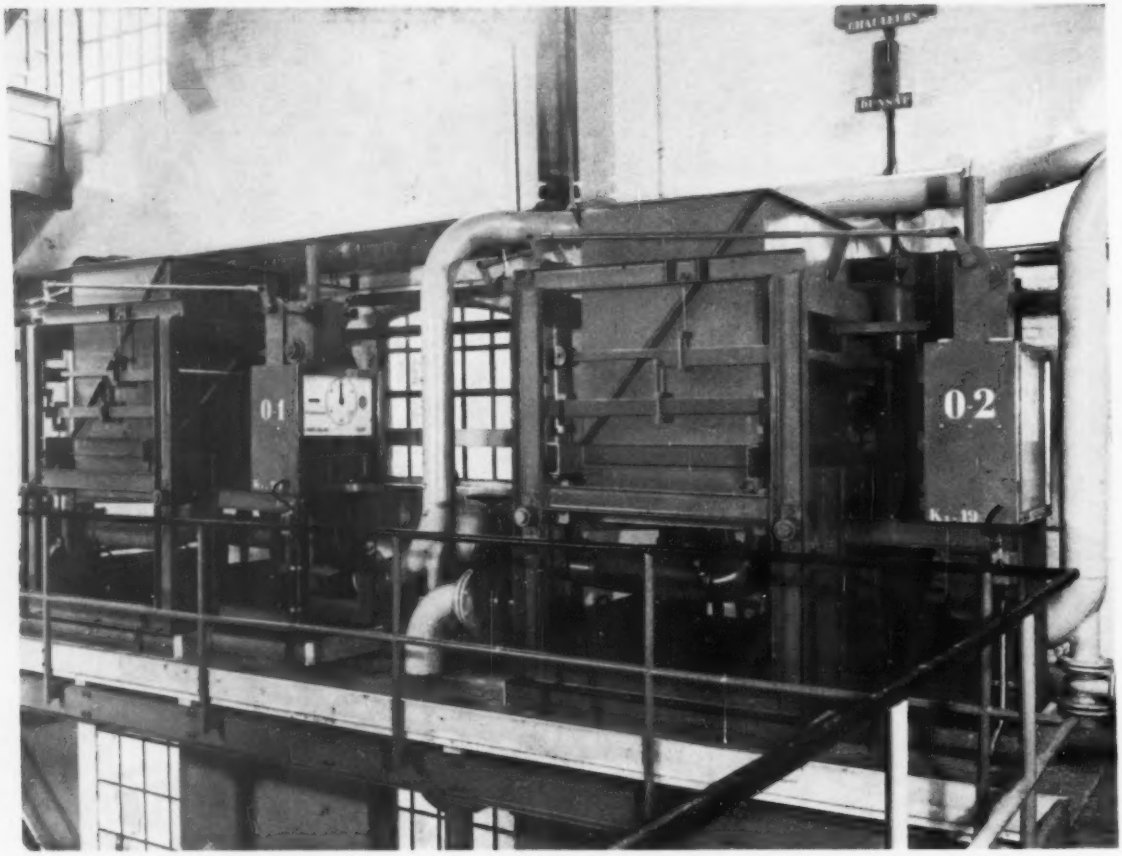
BRANCHES IN LONDON AND MANCHESTER



Two 60 tons/hour sugar juice Duplex weighers installed in a Dutch refinery

What will a DUPLEXWEIGHER do for YOU? — It will:

WORK WITHOUT ATTENDANCE

for it is fully automatic, adapting itself to changes in supply or sepcific gravity of the material to be weighed.

ACCURATELY TOTALISE NET WEIGHTS DISCHARGED

because in each weighing cycle the weigh hopper is weighed twice: first when full and again when the material has been discharged.
Only the weight of the quantity that has actually left the hopper is totalised.

Available for liquids and solids in any hour capacity.

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Every Estate in the Country uses

K. I. W. ROLLERS

ROLLERS by K. I. W.

- MANUFACTURED AND RE-CAST
- UNDER EXPERT SUPERVISION
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- HIGHEST GRADE STEEL SHAFTS
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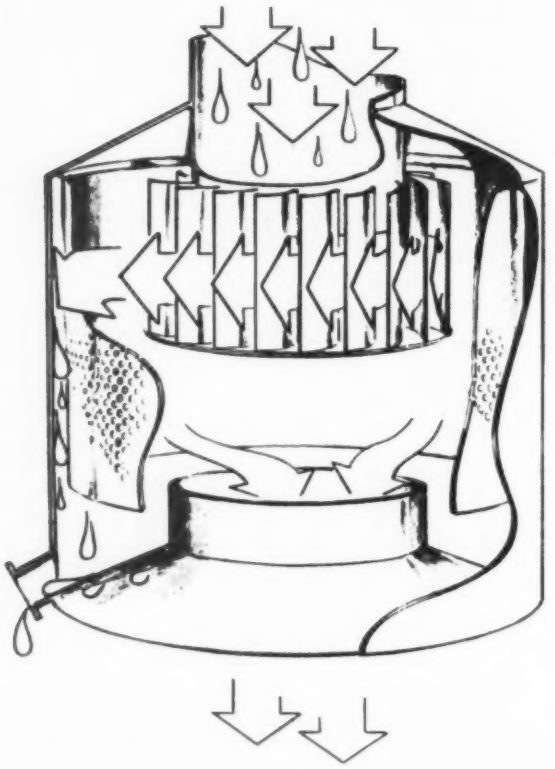
HONIRON centrifugal
ENTRAINMENT SEPARATORS

Low Pressure Loss

Non-Clogging High Capacity



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ON YOUR PANS AND EVAPORATORS
TO REDUCE UNDETERMINED LOSSES

The HONIRON separator is standard equipment on all HONIRON pans and evaporators and it may be adapted easily to existing evaporating apparatus. Hundreds have been installed in pipes ranging from 8 in. to 60 in. in diameter. Write for bulletin S-2!

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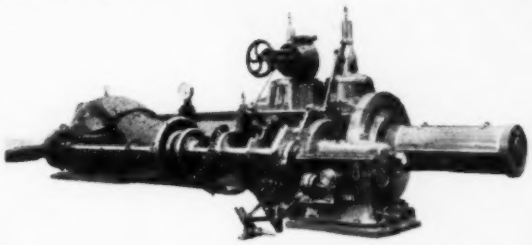

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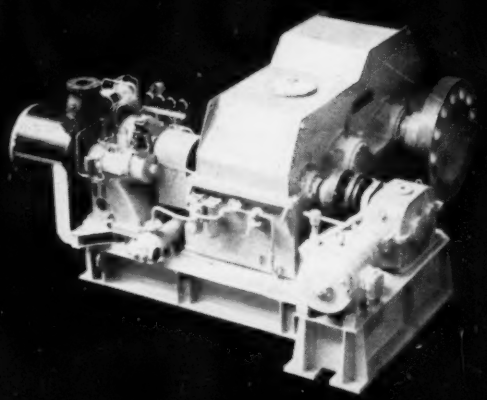
The modern type:

Stork-Werkspoor back pressure turbine (type OT) combined with gearbox, a highly economic light weight drive of small dimensions. Turbine and gearbox are manufactured entirely in our own works.



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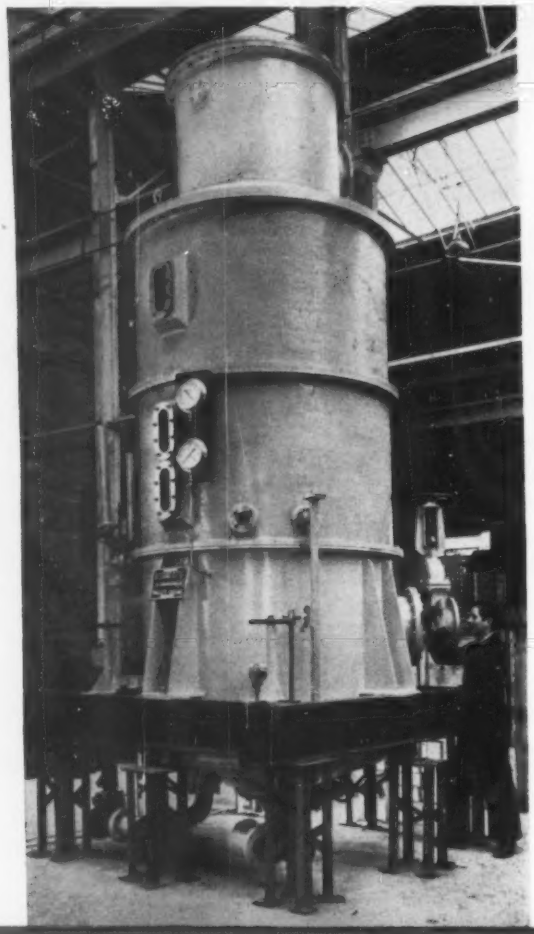
FOR ALL SUGAR MACHINERY APPLY TO GEBR. STORK & CO. N.V. - HENGELO - HOLLAND



Evaporators by

*CRAIG

*** manufacturers of machinery for Complete Sugar Factories**

This illustration shows a sugar factory in India. The complete mechanical equipment for this factory was supplied by Craig.

Your enquiries will have our prompt attention.

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* * *

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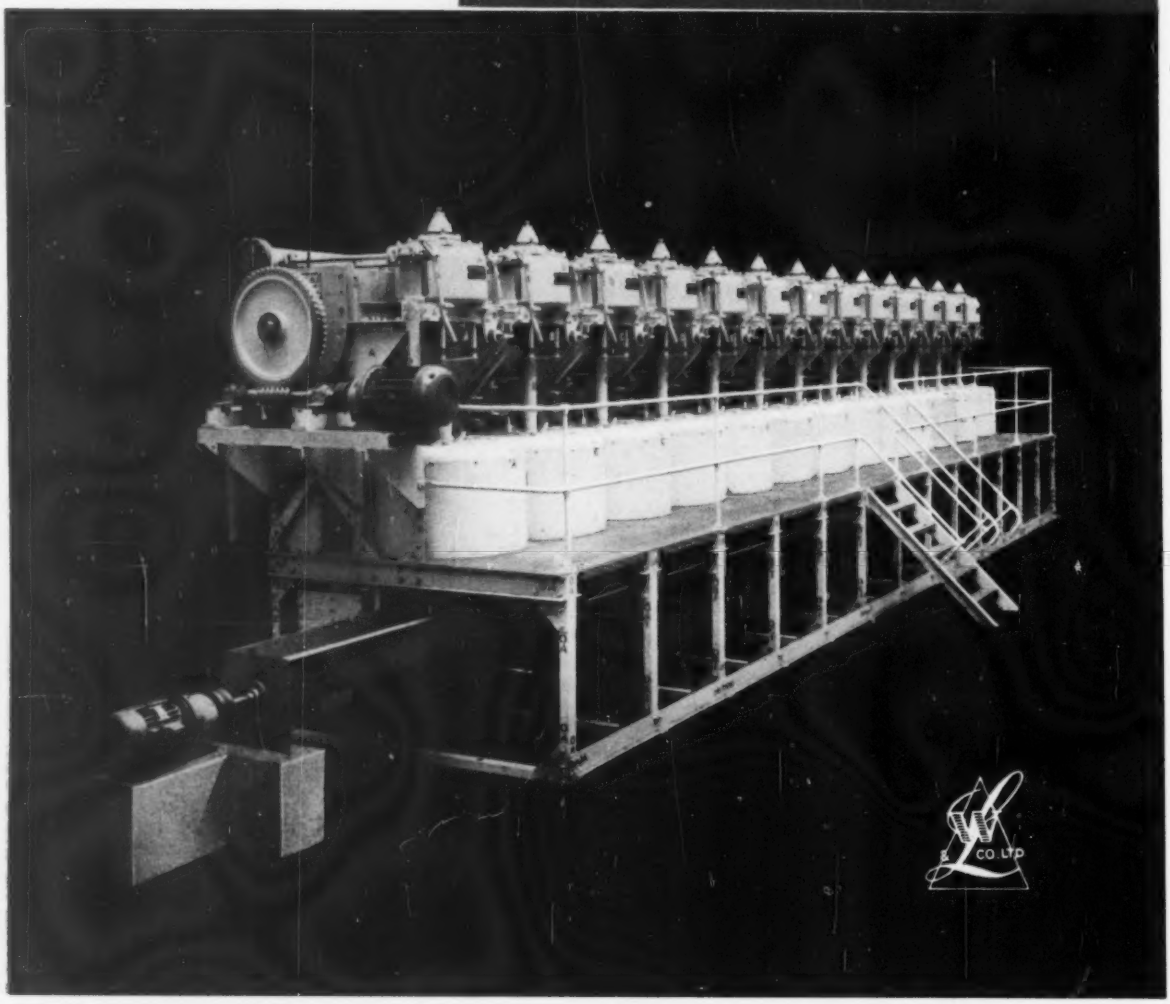

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII JANUARY, 1961 No. 745

NOTES AND COMMENTS

European beet sugar crop, 1960/61.

Details have been released of Licht's second estimates[1] of European sugar production, and appear below, compared with the first estimates of 1st October 1960 and the figures for the 1959/60 season.

(metric tons—raw value)

	1960/61		1959/60
	2nd Estimate	*1st Estimate*	
Germany, West	1,900,000	1,810,000	1,421,367
Germany, East	900,000	900,000	633,105
Austria	266,000	255,000	302,339
Czechoslovakia	1,025,000	1,025,000	733,000
Hungary	440,000	413,000	391,900
France	2,200,000	2,200,000	1,077,812
Belgium	496,000	475,000	218,843
Holland	670,000	620,000	509,700
Denmark	318,000	308,000	252,000
Sweden	320,000	306,000	284,800
Poland	1,275,000	1,275,000	994,400
Italy	950,000	950,000	1,390,000
Spain	528,000	594,000	528,028
Yugoslavia	290,000	290,000	274,051
Roumania	360,000	360,000	363,336
Albania	14,000	14,000	13,500
Bulgaria	180,000	180,000	172,600
Switzerland	35,000	36,600	42,574
Great Britain	900,000	850,000	872,960
Ireland	128,000	128,000	141,977
Finland	62,000	58,000	47,718
Turkey	711,000	660,000	555,274
Europe excl. U.S.S.R.	13,968,000	13,707,600	11,221,284
U.S.S.R.	7,100,000	7,100,000	6,100,000
Europe incl. U.S.S.R.	21,068,000	20,807,600	17,321,284

C. Czarnikow Ltd. comment: "The mild and rainy weather experienced this autumn tended to lengthen the growing season and it is hardly surprising that there should be some upward adjustment to the figures published at the beginning of October. An overall increase of 260,000 tons was rather less than some had expected and it is evident that the additional tonnage of roots has to some extent been at the expense of sugar content. In some parts the continued rains have brought serious flooding; there have, however, been few reports of any interruption in factory operations due to lack of beet supplies, but there can be little doubt that very careful planning has at times been entailed.

"Increases in estimates are fairly widespread throughout Western Europe. Forecasts in respect of Holland, Turkey and the United Kingdom have all been increased by 50,000 tons whilst an additional 90,000 tons is looked for from Western Germany. Increases worth mentioning are also estimated in respect of Austria, Belgium, Denmark and Sweden.

"The only reduction of note is in the Spanish figure which is down by 66,000 tons to 528,000 tons. After allowance has been made for production from cane, this is roughly in line with the 500,000 tons of white sugar set as a ceiling recently by the Spanish Government.

"Eastern European estimates remain unchanged except in the case of Hungary where the estimate is 27,000 tons higher at 440,000 tons."

* * *

International Sugar Council.

The Eighth Session of the International Sugar Council was held on 28th–30th November 1960. H.E. Dr. L. M. GUERRERO (Philippines), Chairman of the Council, presided over the discussions which were attended by representatives of thirty-one countries. The Session which was held in Mexico City at the generous invitation of the Mexican Government was inaugurated by Licenciado Raul Salinas Lozano, Secretary of Industry and Commerce.

The Council adopted an estimate made by its Statistical Committee of the minimum net import requirements of the free market for 1961 amounting to 6,380,000 metric tons, raw value. (Details of the estimate appear on pp. 30–31 of this issue.) Taking account of this first estimate of requirements, the Council, considering that on the basis of the basic export tonnages in Article 14 of the Agreement (6,345,000 tons) of other permissible exports under the Agreement (435,000 tons) and of estimated maximum exports by non-participating countries (approximately 600,000 tons), supplies would exceed requirements by about one million tons; recognising that the impact of certain factors in the sugar market in 1961 is not clear to some members; considering that

[1] *International Sugar Report*, 1960, **92**, (Supp. 22), 270.

in accordance with the Agreement the provisional allocation of initial export quotas is to be followed by a final determination prior to 1st April 1961 by which time it would be in a position more accurately to assess the demand and supply position for that year; decided that initial export quotas for 1961 should be provisionally allocated on the basis of 85% of the basic export tonnages (thus bringing supply and demand into close statistical balance); recognising also that it must take account of the possibility that the structural changes in the sugar market which have occured in 1960 might continue (or even be intensified) in 1961; the Council further resolved to the extent that this occurs to continue so to apply the provisions of Article 8(1) as to take account of the consequences of such structural changes; instructed a special committee appointed for that purpose to keep the market situation and all developments likely to affect the free market under constant review; invited the Chairman to convene a Session of the Council as soon as the factors affecting the sugar market in 1961 are sufficiently known and called upon all participating countries to pursue policies which would support the Council in its endeavours to maintain stability in world sugar production and prices.

The Council received interim reports from its Committee on Sugar Consumption and from the Committee set up during the Sixth Session to prepare for the review of the 1958 International Sugar Agreement which, in accordance with the provisions of Article 42 of that Agreement, will take place in 1961. In this connexion the Council agreed to request the Secretary-General of the United Nations to convene a conference in September next.

The Council approved an application by the Government of Ecuador for accession to the International Sugar Agreement on the conditions specified in Article 14(3) of the Agreement. The Council also considered an application for accession by Colombia and agreed on the conditions for accession to be proposed to that country.

The Council unanimously elected Mr. Keiichi Matsumura of Japan as Chairman and Dr. Yusuf Ismail of Indonesia as Vice-Chairman for 1961. It also approved the composition of its Committees for the year 1961 and adopted its budget for that year.

The Chairman extended to the Mexican Government and to the Mexican Association of Sugar Producers the warm appreciation of the Council for their generous hospitality, for the technical arrangements for the conference and for the kindness and courtesy shown to the Council and to all members of delegations.

* * *

Crop restriction for U.K. beet eelworm control.

Wider powers have been given to County Agricultural Executive Committees to prevent the spread of beet eelworm and to control the degree of infestation in land where eelworm already exists.

Under the new Order made by the Minister of Agriculture, Fisheries and Food, which replaces the existing Order, Committees may serve notices defining infested land on which crops likely to encourage an increase of beet eelworm may not be grown except under licence from the Committee. They may also prohibit the sale for planting of plants and potatoes grown in infested land, instead of only potatoes as previously, and may apply these cropping and other restrictions to allotments and private gardens where plants are grown for sale for planting.

The new Order also empowers Committees to free from cropping restrictions land in which the eelworm population has been sufficiently reduced.

As a result of the Order land in the parishes of Hockwold (Norfolk) and Burwell (Cambridgeshire) and the Grantham and Lincoln Sewage Farms have been added to the areas included in the Schedule of Infested Areas. In these areas restrictions are imposed on the growing of host crops of beet eelworm whether or not eelworm has been found on the land. The parish of Crowland in Lincolnshire (Holland) and four sewage farms have been deleted from the Schedule.

Beet eelworm attacks not only beet and related crops but also cruciferous crops (brassicas etc.) on which the eelworms are equally capable of multiplying in the soil, usually without any obvious crop symptoms. The susceptible or host crops include sugar beet, fodder beet, mangolds, red beet, spinach beet, cabbage, kale, cauliflower, broccoli, brussels sprouts, turnip, swede, rape or coleseed (including turnip, rape and swede rape), mustard, cress, radish and kohl-rabi.

Beet eelworm was first found attacking sugar beet in this country in 1934. The danger to the British beet sugar industry was emphasised by the disastrous experiences in Germany, where continuous cropping with sugar beet produced such heavy beet eelworm infestation that crop yields diminished almost to nothing over large areas and many beet sugar factories had to be closed. To prevent a similar disaster in England, action was taken first by the British Sugar Corporation through their contracts with growers and later by the Minister of Agriculture through the Sugar Beet Eelworm Orders of 1943, 1950 and 1952.

* * *

Our cover.

Readers will have observed that we have changed in this issue to a new cover of modern design, replacing the Walter Crane design that has given such good service during the past 48 years. An outstanding characteristic of our past cover has been its instant recognizability; we feel sure that our new cover will achieve the same within a short time. We would like to place on record our grateful thanks to Mr. WILLIAM DONALDSON, of A. & W. Smith & Co. Ltd., for his help in preparing the new design.

SAMPLING STUDIES OF SUGAR CANE FOR JUICE ANALYSIS

By S. C. SEN

(Central Sugarcane Research Institute, Pusa, India.)

IT has been shown by SEN[1] that the variation of pol content among individual canes is greater than the variation of pol content among individual clumps of the same variety growing on the same field, and he suggested that clump-wise sampling would lead to a more reliable result than cane-wise sampling. This recommendation of clump-wise sampling is in agreement with the observations made by KHANNA and SEN[2] and RAMJI NARAIN and ARMAT SINGH[3] and others. SEN also proved statistically by analysing all the clumps individually in a plot of $^1/_{40}$ acre that the number of clumps required to be sampled in a plot, to ensure reliable results, varied widely. It ranged between 32 and 7 whole clumps in ten observations, which is really very great.

The present investigation has therefore been taken up with a large number of plots to ascertain the minimum number of clumps necessary for sampling in a plot to ensure a reliable result.

Experimental

One acre plot under general observation with Co 453 at the Central Sugarcane Research Institute, Pusa, Bihar, was divided into 80 equal plots each $^1/_{80}$ acre in size. The analysis of each and every clump in each plot of $^1/_{80}$ acre was completed within 60 days, beginning from January, in the period of optimum maturity.

The juice analysis (pol content only) data were statistically calculated to determine the number of clumps per plot to be required for the assessment of a reliable result (Table I).

Table I

Plot No.	*No. of clumps per plot*	*Mean Pol. % juice*	*S.E. clump*	*No. of clumps required for reliable result*
1	74	15·038	1·71	*19·79*
2	65	15·265	1·91	*23·94*
3	65	15·740	1·37	11·65
4	52	16·090	1·36	10·96
5	99	16·000	1·49	*13·29*
6	99	15·900	1·52	*14·09*
7	51	16·481	1·18	7·96
8	78	15·879	1·03	6·52
9	73	16·039	1·20	8·76
10	68	16·133	1·22	8·85
11	78	16·354	0·85	4·15
12	76	16·133	1·22	8·85
13	77	16·354	0·85	4·15
14	81	16·030	1·30	10·02
15	69	15·547	1·08	7·43
16	68	15·790	1·17	8·51
17	82	15·170	1·37	*12·57*
18	54	15·370	1·40	*12·87*
19	56	15·952	1·07	6·90
20	83	15·620	1·36	11·74
21	66	15·366	1·06	7·38
22	61	15·758	1·08	7·26
23	66	15·436	1·15	8·58
24	55	15·430	1·04	6·96
25	70	15·326	1·26	10·32
26	67	15·760	1·26	9·82
27	55	15·827	1·27	9·92
28	73	15·712	1·11	7·70
29	53	15·619	1·19	8·93
30	66	15·780	1·09	7·32
31	84	15·800	1·29	10·25
32	69	15·621	1·26	9·92
33	83	15·893	0·98	5·84
34	66	16·364	1·21	10·19
35	47	15·640	1·60	*16·03*
36	65	14·905	1·84	*23·54*
37	57	15·920	1·41	12·07
38	50	15·927	1·24	9·28
39	68	16·058	1·14	7·68
40	60	16·682	1·26	8·82
41	81	16·813	1·09	7·05
42	71	16·382	1·14	7·44
43	65	15·874	1·10	7·42
44	86	16·230	1·14	7·64
45	53	15·930	1·42	12·17
46	67	16·395	1·02	5·96
47	41	16·057	0·96	5·47
48	78	16·164	1·19	8·33
49	72	16·225	0·87	4·47
50	70	16·666	1·07	6·34
51	75	16·425	1·26	9·11
52	65	16·612	1·05	6·15
53	54	16·835	1·03	5·83
54	57	16·394	1·23	8·70
55	76	16·735	1·25	8·62
56	69	16·543	0·87	4·21
57	70	16·504	1·12	7·07
58	69	16·500	0·96	5·14
59	66	16·590	0·98	5·34
60	59	16·673	0·92	4·72
61	69	16·288	0·93	4·99
62	78	16·263	1·07	6·62
63	44	16·210	1·22	8·75
64	60	16·025	1·00	6·01
65	59	16·222	1·11	7·18
66	80	16·250	1·02	6·11
67	53	16·230	1·19	8·24
68	62	16·190	1·06	6·56
69	56	16·363	1·08	6·64
70	53	16·320	1·20	8·33
71	49	16·395	1·09	6·80
72	58	16·955	1·18	7·50

Remarks

Italics indicate that the canes were damaged by jackals. 8 plots were very badly damaged by jackals and their analysis was not carried out.

Calculations : $t_{.05} = \dfrac{0{\cdot}05 \times \text{mean}}{\text{S.E.} \sqrt{\dfrac{1}{n}}}$

where n = required number of clumps.

[1] *Sci. Soc. H.B.T.I. and N.S.I.*, 1957, **6**, 36–43.
[2] *Dept. Agric. Bihar Leaflet*, 1937, (3).
[3] *Indian J. Agric. Sci.*, 1937, **41**, 601–645.

The mean value of the number of clumps required for juice analysis excluding data for 8 plots is equal to 7·87 clumps. And including all the values, the number of clumps calculates to 8·84.

Table II

Analysis of variance of the observations

Variations	*Degrees of freedom*	*Sums of squares*	*Mean square*	*S.E.*	*General mean*	*5% of General mean*
Between plots	71	3204·79	45·14			
Within ,,	4722	8220·69	1·741	1·320	16·04	0·802
Errors	4793	11425·48				

The number of clumps required to be sampled for analysis on the basis of the pooled error found from 72 plots:

$$\sqrt{n} = \frac{1{\cdot}96 \times 1{\cdot}32}{0{\cdot}802}$$

$$\therefore n = 10{\cdot}41.$$

A difference of 5% in the pol value is ordinarily allowed as admissible—taking this margin as the Standard, it has been found, by a study of intraclass correlation that ten whole clumps taken at random in a plot of $^1/_{80}$ acre will serve as the satisfactory sample size to get a dependable estimate of pol % juice.

Acknowledgment

The author is indebted to Sri K. L. KHANNA, B.Sc. (Agri.), Assoc.I.A.R.I., F.A.Sc., Director, Central Sugarcane Research Institute, Pusa, for his kind encouragement and guidance in this investigation and my thanks are due to Dr. K. S. BANDOPADHYA, M.A., D.Phil., Statistician, C.S.R.I., Pusa, for drawing up the statistical conclusion.

[It should be pointed out that this requirement of 10 clumps to be sampled for reliable results is between one-tenth and one-quarter of the total number of clumps in the plot, and is about one-seventh on average. The necessity of sampling such a large proportion would presumably prevent its adoption on the commercial scale—*Ed.*]

AGRICULTURAL ABSTRACTS

Overhead irrigation. *Mauritius Chamber of Agriculture Ann. Rpt.*, 1959–60.—A section of the Report deals with the financial aspects of such irrigation. Experience suggests a probable saving of 60% water on free soils and 84% on gravelly soil as compared with surface irrigation. Relative cost per arpent of overhead irrigation is, however, nearly double in the case of free soils and 34% higher on gravelly soil; the respective figures per ton cane were over double and 42%. Electric power, when avaliable, is expected to reduce costs by 60% with a further reduction from the use of improved sprinklers.

* * *

Gravimorphism in sugar cane. J. C. SKINNER. *Tech. Comm., Bureau Sugar Expt. Sta.*, 1960, (1), 1–8.—Gravimorphism is a term, introduced in 1958, to indicate the effect of gravity on growth. The experiments here described were directed to ascertain if gravity in any way influenced the flowering of cane—an important point of view of the difficulty in making crosses between certain new varieties which fail to flower or whose times of flowering do not synchronize. Stalks were bent over and kept in the horizontal position for a period of 4 months. No flower induction followed treatment and photoperiodism and temperature remain the major known factors controlling flowering; the number of internodes was unaffected, but lengths of internode and leaf sheath were markedly reduced with a loss of apical dominance as shown by an increased development of laterals.

A wilt disease of velvet bean. O. W. STURGESS and B. T. EGAN. *Tech. Comm., Bureau Sugar Expt. Sta.*, 1960, (2), 9–13.—Velvet bean has been widely grown as being less subject to disease than members of the cow-pea group. That resistance appears to be breaking down through attacks of *Phytophthora drechsleri*.

* * *

Studies with chlorotic streak disease of sugar cane. O. W. STURGESS. *Tech. Comm., Bureau Sugar Expt. Sta.*, 1960, (3), 15–19.—The experiments with nutrient solutions in gravel and under glass show that chlorotic streak can be transmitted from diseased to healthy plants grown together or when grown apart and with a subsequent interchange of plants without direct contact.

* * *

The insect pests of sugar cane in India. VI. The stalk borer. B. D. GUPTA. *Indian Sugar*, 1960, **10**, 67–76.—A very detailed description of the stalk borer (*Chilotraea auricilia*) is given together with recommendations for its control.

* * *

The effect of saline conditions on sugar cane. K. C. LEVERINGTON. *Tech. Comm., Bureau Sugar Expt. Sta.*, 1960, (4), 21–25.—With the extension of cultivation of cane to marginal lands the problem of salinity arises. Cultures in nutrient-sand media, adjusted to osmotic concentrations ranging from 0·5 to 4·5 atm., showed sharp and increasing reductions in height and in weight both of shoots and roots at concentrations above 1·5 atm.

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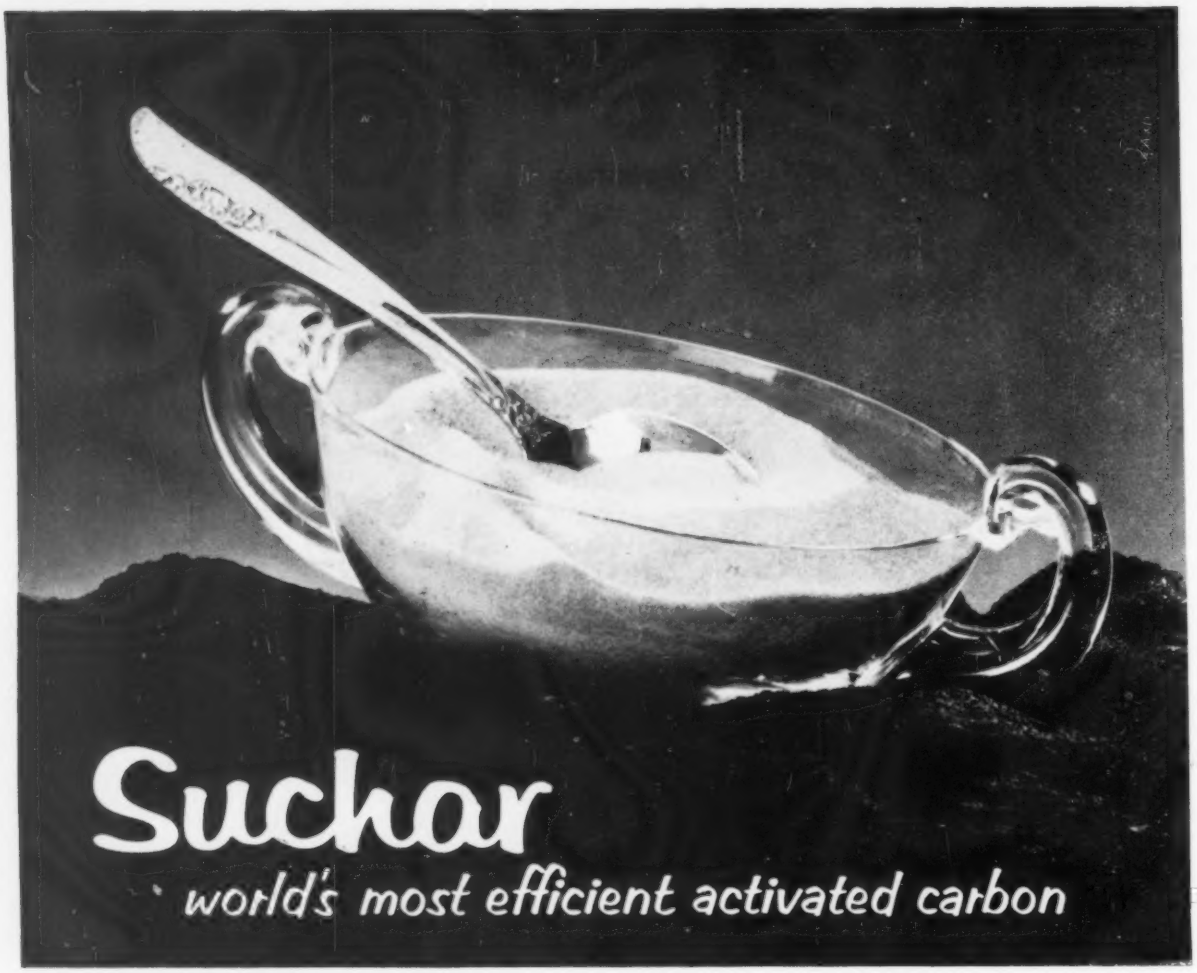

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SUGAR CANE AGRICULTURE IN MAURITIUS

MAURITIUS SUGAR INDUSTRY RESEARCH INSTITUTE, SEVENTH ANNUAL REPORT, 1960

Cane Breeding and Selection

THE major development in cane breeding technique has been a preliminary trial of the method, pioneered in South Africa, of conducting crossing under controlled conditions in the greenhouse. The tests were sufficiently successful to lead to an expansion of the method by which a wider choice of parental varieties and an increased yield of seed is anticipated. A card indexing system has also been adopted for recording the results of later varietal selection. Bunch planting is also being continued.

Pre-release trials are of two kinds, 6 randomized blocks of 4 plots with one standard variety followed by 6 randomized blocks of 6 plots, with repetition in various parts of the Island. All receive a heavy dressing of N to help eliminate those varieties tending to lodge and help select those having the greatest production potential.

Of the total estate-grown cane crushed M 134/32 formed 34%, Ebène 1/37 28% and M 147/44 13%, but the distribution varies according to the climatic regions. Two varieties have been released for commercial cultivation: M 202/46 (Co 281 × M 63/39) and M 93/48 (Ebène 1/37 × M 63/39). The "relative benefit" of the latter under Hugot's formula $= \left[\frac{\text{tons cane/arpent (c.c.s.} - 4)}{100}\right]$ as compared with B 3337 is presented diagrammatically.

Nutrition and Soils

Nitrogen: Urea, under test since 1956, has proved to be definitely inferior to sulphate of ammonia at doses above 30 kg N per arpent, below which figure the plant response to it appears to be favourable. From variety trials it would appear that in Mauritius-bred varieties, quality is more adversely, and even severely, affected by over-doses of N than in other varieties.

Phosphorus: Mauritius soils are, broadly, deficient in P. Application of guano at 1 ton per arpent at planting has become common. For ratoons, heavier dressings of guano, with small dressings of soluble phosphate where deficiency is indicated, have proved profitable. The question of placement arises, particularly in soils with a P-deficient sub-soil and following deep cultivation.

Organic matter: The amount of nutrient in trash, tops and roots is calculated and the amount of organic matter in a 7 crop cycle is placed at 42 tons, corresponding to 120 tons "fumier", but Mauritius experience shows no response to organic matter *per se* and the question of its humification is unimportant.

Soil survey: An important feature of cultivated land in Mauritius is that of "rockiness", that is, the extent of exposed rock or rock covered with too thin a layer of soil to allow cultivation. As a result of a survey, the extent of rockiness has now been mapped.

Diseases

A general review of the disease position is given covering both the establishment of nurseries and the distribution of hot-water treated setts for commercial planting. Various methods for overcoming the disadvantage of low germination in such setts are under trial. Cooperative work with Madagascar, where Fiji disease is prevalent, has been initiated.

Pests

With the growing realization of the rôle played by nematodes as a pest, the identification of the numerous species is being pursued, and small plot experiments treated with EDB showed marked increases in yield.

Consignments of *Tetrastichus israeli* and *Stenobracon nicevillei*, parasitic on the stalk borer *Proceras saccharophagus*, have been received from India.

The white grub (*Clemora smithi*) has ceased to be the dominant pest, a position reached in part by the introduction of Scoliid wasps. Insecticides, "Chlordane" and "Eldrin", give control but complexities arise as to quantities and placement, if cane growth is not to be adversely affected. Localized outbreaks of scale insect (*Aulacaspis tegaleusis*), army worm (*Leucania loreyi*), cottony scale (*Pulvinaria iceryi*) and leaf hopper (*Tytthus mundulus*) are noted. *Perkinsellia saccharicida*, the natural enemy of the last, introduced in 1956/57, is now dispersed over the whole island.

Weed Control

DCMU and CMU have given excellent control of annual weeds, owing to low solubility particularly effective in super-humid and irrigated areas. "Dowpon" gives excellent control of grasses including *Cynodon dactylon* of which a special study has been made. This shows the presence of 4 morphological races identifiable by the epidermal pattern of the stolons and chromosome numbers. This clonal differentiation may account for the discordant responses to the herbicide. Notes are given on the control of other weeds.

Cultivation, Irrigation and Climate

The regression equations worked out to correlate rainfall with yield and quality and noted in earlier reports have been regionally applied and carried to a stage justifying definite conclusions. These are too complex to detail but have a practical bearing in determining the date of commencing harvest, thus replacing laboratory tests for quality.

Comparison between farmyard manure, molasses and scums with mineral fertilizers all favour the last on an economic basis. Of particular interest is the increased yield in super-humid regions from the application of basalt dust since 1947[1] when the trial was first started.

Exploratory trials with overhead irrigation in the sub-humid regions show a great economy in water consumption.

H. M.-L.

[1] *I.S.J.*, 1950, **52**, 118.

Effect of organic manures including green manuring and inorganic fertilizer on the sustained fertility of soil. R. D. REGE. *Indian Sugar*, 1960, **10**, 83–86.—A general review of the problem of maintaining soil fertility in India. The important rôle of organic matter is fully recognised but the basic difficulty is shown to be that, even if all available sources were tapped, the amount available would be inadequate.

* * *

Manurial schedule in respect to phosphate absorption through foliar analysis. I. Determination of leaf for phosphate index. S. C. SEN and J. C. BHARGAVA. *Indian Sugar*, 1960, **10**, 79–81.—Data are given to justify the choice of the 4th leaf for analysis.

* * *

Manurial schedule in respect to phosphate absorption through foliar analysis. II. Effect of different doses of phosphate in soils in relation to its absorption by sugar cane. J. C. BHARGAVA and S. C. SEN. *Indian Sugar*, 1960, **10**, 147–152.—The effect of dressings of P_2O_5 (as superphosphate) at rates varying from 50–200 lb/acre as determined by 4th leaf analysis, showed no statistical differences, only a trend in favour of the 50 lb or 100 lb dressing.

* * *

Relative efficiency of seed treatment on germination. R. MUTHUSWAMY. *Indian Sugar*, 1960, **10**, 155–157.—Of the numerous substances tested, "Aldrex 30" (0·2 lb "Aldrin" equivalent) plus "Aretan 6%" (0·25 lb) or "Agallol" (0·5 lb) in 10 gallons water yielded the best results.

* * *

Flowering studies on sugar cane in Madhya Pradesh. D. S. UMAT. *Indian Sugar*, 1960, **10**, 171–173.—The results of these studies may be summed up by saying that it is not the total amount of water available to the crop during the growing season (July–Sept.) but its availability during the entire period of growth that is important; in other words, a certain minimum growth is essential before the plant can enter the reproduction phase.

* * *

Report of a mission to Mauritius and Réunion. P. BAUDIN. *Rev. Agric.* (Réunion), 1960, **60**, 29–40.—Mauritius, Réunion, Madagascar and, to a lesser extent, Natal are linked by the Indian Ocean and these territories face a common problem of checking the spread of diseases, some of which have not yet appeared in one or other of them. Basically this is a question of testing varietal resistance, more particularly of those varieties which it may be proposed to introduce into a territory where one or more of the diseases do not occur. A summary is given of the information available on these varietal relationships with the more important diseases, gummosis, ratoon stunting disease, Fiji disease and leaf scald.

* * *

Tests of mechanical cane harvesters in Puerto Rican fields. J. B. GARCÍA MENDEZ. *Sugar J.* (La.), 1960, **23**, (1), 31. —Comparative harvesting figures for 1958, in man-hours per ton cane, are quoted as follows: Florida 2·27, Hawaii 1·82, Puerto Rico 10 79. Even the incentive scheme adopted has produced little improvement, the fundamental difficulty being union opposition. A brief account is given of preliminary trials of two harvesters and of the difficulties encountered.

* * *

Mechanization of field equipment—the problems and prospects. A. ROIG. *Sugar J.* (La.), 1960, **23**, (1), 49–53.—A further study is given of the problem of meeting the high cost of labour by mechanization and of the difficulties encountered covering not only harvesting but field operations generally.

* * *

Particles associated with the ratoon stunting disease in sugar cane. I. L. FORBES and K. C. LING. *Sugar J.* (La.), 1960, **23**, (2), 15.—Using the electron microscope two sizes of particles were found in the leaf juice of diseased plants. Similar juice of a healthy plant showed none.

* * *

Soils of the Hawaii sugar cane plantations. J. R. BONNET. *Sugar J.* (La.), 1960, **23**, (2), 17–24.—The different soil types are reviewed in relation to their environment and their various reactions such as to phosphate fixation are noted.

* * *

Responses of sugar cane to gibberellic acid. R. E. COLEMAN *et al. Sugar J.* (La.), 1960, **23**, (3), 11–21.—This is a paper read at the Tenth Meeting of the I.S.S.C.T., but in a condensed form. A wealth of data is given with the numerous responses to the acid applied by various methods, but none of them suggest that increased sugar production will result.

* * *

Notes and diagrams on overhead irrigation in Cuba. H. G. SORENSEN. *Sugar J.* (La.), 1960, **23**, (3), 23–26.—Details are given of the system adopted at Central Jaronú with a diagram of the layout and with especial emphasis on points to be observed for night irrigation. The financial aspect is not stated.

THE PRESSURE REQUIRED TO FEED CANE MILLS

By C. R. MURRY, B.E., A.M.I.E.(Aust.)

(Sugar Research Institute Fellow, Dept. of Mechanical Engineering, University of Queensland)

Part II—Comparison with experimental results

10. Sample Calculation

Consider a 84 in × 36 in mill crushing 127 tons cane per hour at 30 ft per min. with a feed roll compression ratio of 1·5 Assume that the prepared cane gives the pressure-compression ratio curve of the coarse preparation of Table 2 and that the coefficient of friction is 0·364.

Then we have:

$\mu = 0{\cdot}364, \qquad \beta = 20^\circ$

$q_c = 676$ lb per min per ft,

$p_v = 162\ (C - 0{\cdot}482)^2$,

$\frac{d_a}{d_o} = 0{\cdot}482, \qquad d_a = 34{\cdot}2$ lb per cu.ft.,

$C_N = 0{\cdot}2196$,

$C_o = 1{\cdot}5$, and $\frac{W_o}{D} = 0{\cdot}0706$

The angle α at which cane contacts the rolls is given by solving equation 3.

$$\cos\alpha = \tfrac{1}{2}(1 + \frac{W_o}{D}) + \sqrt{\tfrac{1}{4}(1 + \frac{W_o}{D})^2 - C_N} \quad ..(14)$$

Note that this is the same as the expression for $\frac{h_a}{D}$ (equation 13) but with the negative sign in front of the radical changed to a positive sign. Substituting the values of $\frac{W_o}{D}$ and C_N we get

$\cos\alpha = 0{\cdot}793$ and $\alpha = 37{\cdot}5^\circ$

Tabulation in 2° steps and integration by the trapezoidal rule will be used to find the integral of equation 12 with the aid of equations 7 and 9.

The area under the curve represented by the values of column 10 is given to a first approximation by

$$2 \times \frac{i}{57{\cdot}3}(y_o + 2y_1 + 2y_2 + \ldots\ldots + y_n)$$

where i is the tabulation interval in degrees and y_o, y_1, etc., are the tabulated values.

Since $y_o = 0$ and $y_n = 0$‡

‡ The last interval is not necessarily equal to i but the error introduced is very small.

$$\int_\beta^\alpha p_v \cos\theta \tan(\theta - \beta)\, d\theta \simeq \frac{i}{57{\cdot}3}(y_1 + y_2 + \ldots + y_{n-1})$$

That is, the integral is given by the sum of the values in column 10 multiplied by $\frac{i}{57{\cdot}3}$

From equation 12

$\frac{h_a}{D} = 0{\cdot}2774$

Since the values of p_v are in lb per sq. in. we have from equation 13

$$p_F = \frac{2{\cdot}939 \times 2}{57{\cdot}3} \times \frac{1}{0{\cdot}2774} \times 144$$

$= 53{\cdot}3$ lb per sq.ft.

11. Solutions for 30 ft per min and Fine Preparation

A set of solutions with $\mu = 0{\cdot}36$ and using the equation for medium preparation is presented graphically in Fig. 3. It will be seen that the feed pressure rises steeply as the capacity number increases and that this increase in pressure is more marked at high compression ratios.

1	2	3	4	5	6	7	8	9	10
θ	Cos θ	$(1 + \frac{W_o}{D}) - \cos\theta$	$\frac{\text{Cos }\theta(1 + \frac{W_o}{D} - \cos\theta)}{\text{Cos }\theta(1 + \frac{W_o}{D} - \cos\theta)}$	$\frac{C_o \frac{W_o}{D}}{\text{Cos }\theta(1 + \frac{W_o}{D} - \cos\theta)}$	$(C\theta - \cdot 482)$	$(C\theta - \cdot 482)^2$	$p_v = 162\ (C\theta - 0{\cdot}482)^2$	$\tan(\theta - \beta)$	$p_v \cos\theta \tan(\theta - \beta)$
20	0·9397	0·1309	0·1230	0·862	0·380	0·1444	23·39	0	0
22	0·9272	0·1434	0·1330	0·797	0·315	0·0992	16·07	0·0349	0·521
24	0·9135	0·1571	0·1435	0·739	0·257	0·0660	10·69	0·0699	0·683
26	0·8988	0·1718	0·1544	0·687	0·205	0·0420	6·80	0·1051	0·643
28	0·8829	0·1877	0·1657	0·640	0·158	0·0250	4·05	0·1405	0·502
30	0·8660	0·2046	0·1772	0·598	0·116	0·0135	2·19	0·1763	0·334
32	0·8480	0·2226	0·1888	0·561	0·079	0·0062	1·00	0·2126	0·180
34	0·8290	0·2416	0·2003	0·529	0·047	0·0022	0·36	0·2493	0·075
36	0·8090	0·2616	0·2116	0·501	0·019	0·0004	0·06	0·2867	0·001
								TOTAL....	2·939

Experiments show (see later) that at approximately constant feed pressure the maximum crushing rate is a linear function of the work opening. That is,

$$q_c = a\ W_o + b$$

where a and b depend on the experimental conditions. From equation 10

$$q_c = C_o\ W_o\ d_o\ S$$

and hence

$$\frac{1}{C_N} = \frac{d_a D S}{b} - \frac{d_a}{d_o}\frac{a}{b}\frac{1}{C_o}$$

That is, plotting $\frac{1}{C_N}$ against $\frac{1}{C_o}$ gives a straight line.

On this basis the lines of Figure 4 for constant feed pressures have been drawn by taking horizontal lines in Figure 3. These lines are straight to a first approximation.

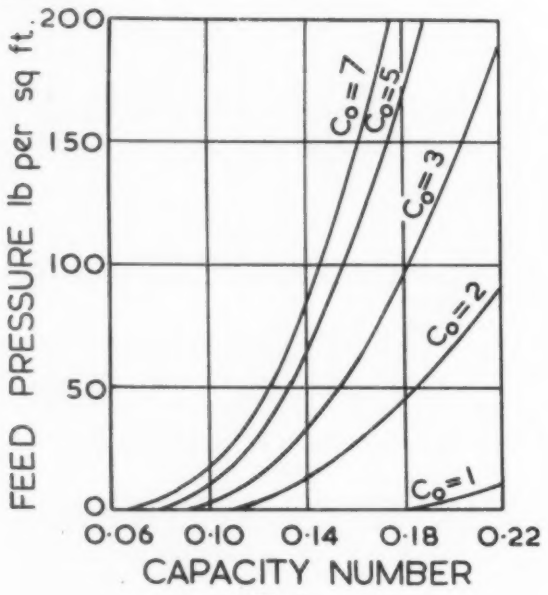

Fig. 3

12. Comparison of Theoretical Solutions with Experimental Results

Experiments have been carried out on the feeding ability of the two-roll experimental mill in the University of Queensland. These experiments have been previously reported[1,9]. Prepared cane, slightly precompressed to give a rectangular block, is fed to the mill by hand. A pressure of about 60 lb per sq.ft. is applied to the block of cane. This pressure is limited by the buckling strength of the block. The weight of cane fed is gradually increased until the mill will not accept the feed.

Changing Work Opening.—The results of an experiment at constant speed (20 ft per min.) and preparation (mean bulk density at 7·5 lb per sq.in. = 43·2 lb per cu.ft.) and varying work opening are given in Appendix I. These results indicate a linear trend of maximum crushing rate with increasing work opening.

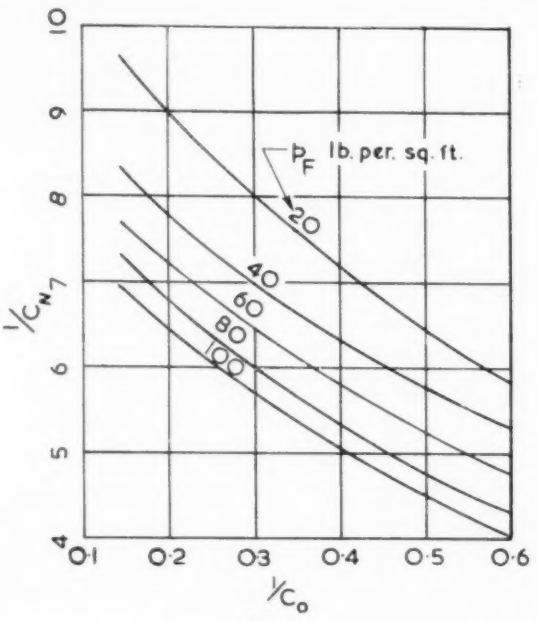

Fig. 4

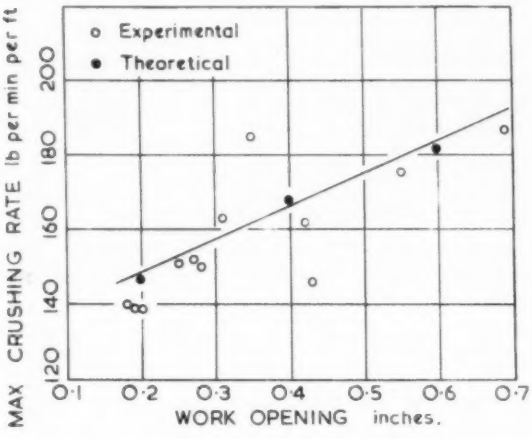

Fig. 5

The theoretical rates for these conditions have been found. The preparation most like that of the experiment has been chosen from Table 2 on the basis of bulk density at 7·5 lb per sq.in. This is the "coarse" preparation. The theoretical rates for three work openings have been calculated by successive approxi-

[9] Murry: *Proc. 26th Conf. Queensland Soc. Sugar Cane Tech.*, 1959, 191; *I.S.J.*, 1960, **62**, 255.

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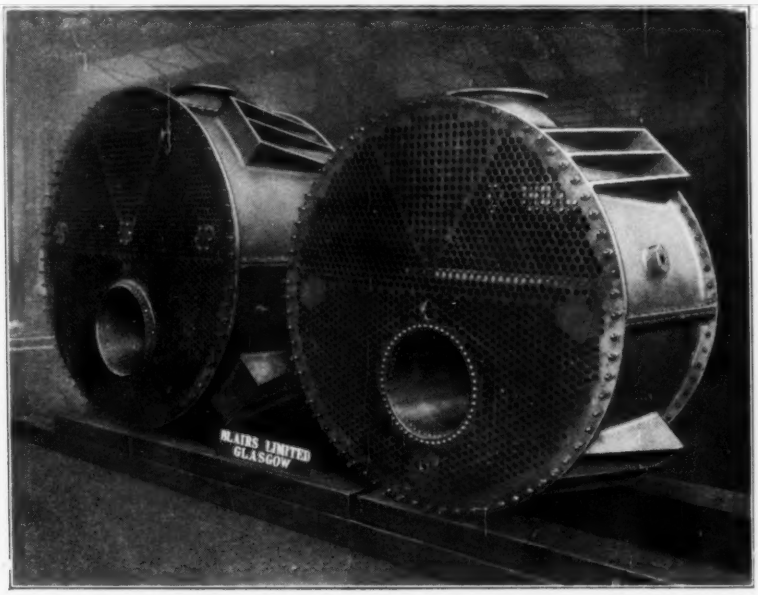

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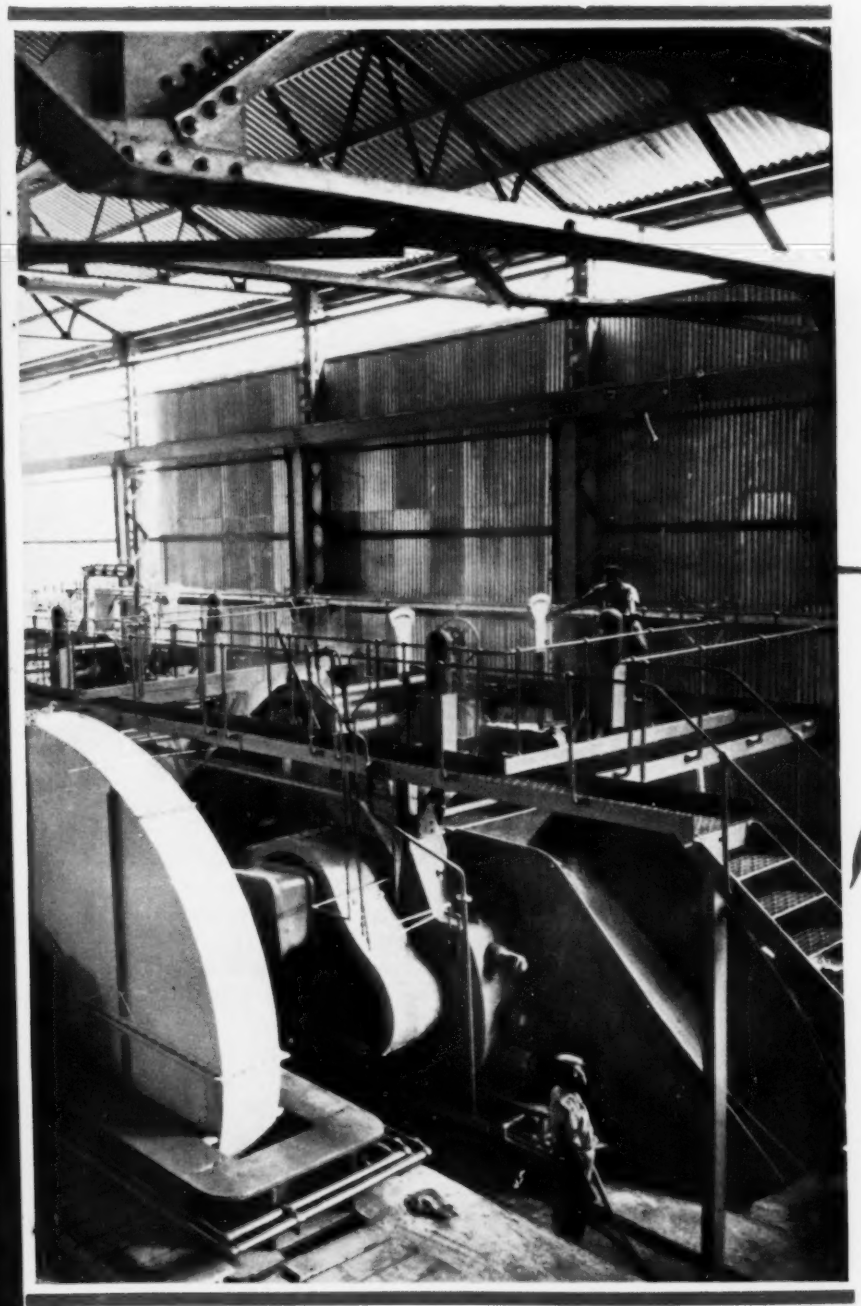

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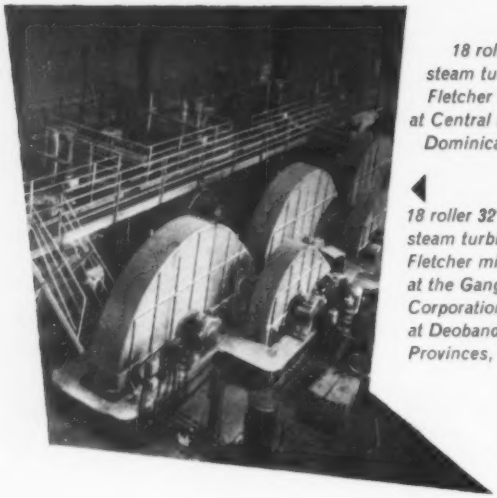
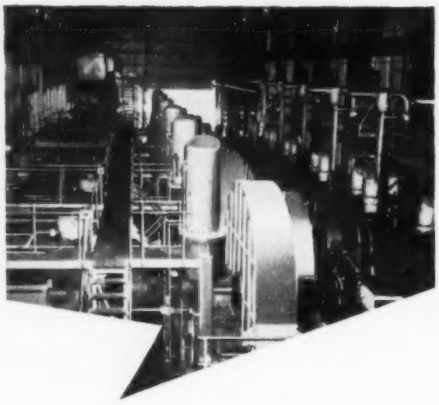


18 roller 34" x 66" steam turbine driven Fletcher mill tandem at Central Boca Chica, Dominican Republic.



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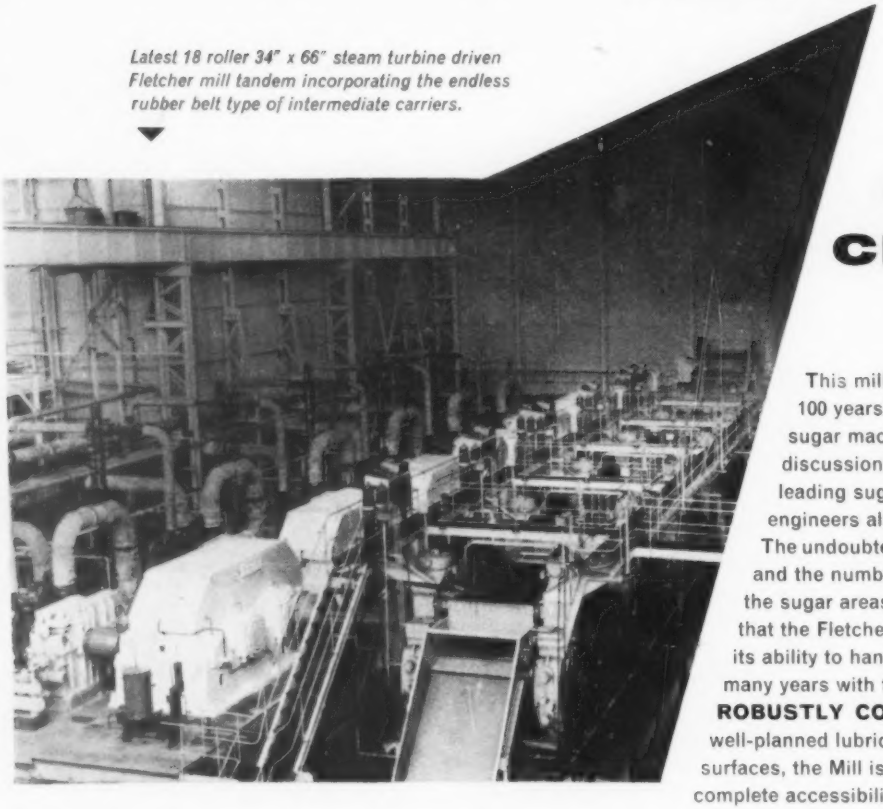

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mation. That is, an estimated value of C_N was taken and the corresponding feed pressure calculated. The value of C_N was then adjusted so as to move the feed pressure towards 60 lb per sq.ft. and the feed pressure re-calculated. The process was repeated until a satisfactory value of C_N (giving $p_F = 60$ lb per sq.ft.) was obtained. Three calculations are usually sufficient.

From the values of C_N so obtained and the feed density for the coarse preparation the theoretical value of the maximum crushing rate was calculated. These theoretical tesults are plotted in Fig. 5 together with the experimental results from Appendix I. In view of the hand-feeding methods used in the experiment the agreement is remarkably good.

Changing Preparation.—The results of an experiment at constant speed (30 ft per min.) and constant work opening (0·228 in) are given in Appendix II. The theoretical rates for these conditions and for the three preparations of Table 2 have been found by successive approximation. These theoretical results have been plotted in Figure 6 together with the experimental results. The agreement is again satisfactory.

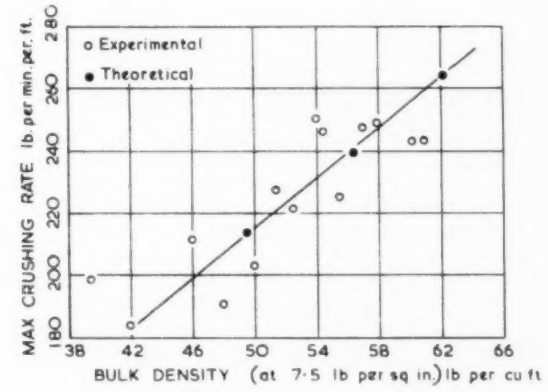

Fig. 6

Changing Speed.—The theoretical results for conditions of constant work opening (0·4 in) and constant preparation (medium) have been calculated. This line is drawn on Fig. 7. An experiment performed by BULLOCK[1] was selected for comparison. The The preparation used had a similar feed density to that of equation 7 for medium preparation. The experimental results are tabulated in Appendix III and plotted on Figure 7. Again the agreement is satisfactory.

The above comparisons show that the theory produces satisfactory results for changes in the three most important milling variables, viz., work opening, fineness of preparation and roll surface speed. Since the theory does not depend on the actual milling experiments in any way, it is felt that it may be applied to any mill—providing the coefficient of friction and the pressure-compression ratio curve are known or can be reasonably assumed.

13. CONCLUSIONS

It appears that a satisfactory method of calculating the feed pressures required to feed cane mills has been developed. The method requires a knowledge of the coefficient of friction between the prepared cane and the roll surface and of the pressure-compression ratio characteristic of the prepared cane.

It is not known at this time whether the method will give satisfactory results for feed pressures in excess of about 100 lb per sq.ft., but since the theory does not depend on empirical data there is no reason to believe that it will not. At higher pressures it may be necessary to take account of the change in coefficient of friction with preparation and pressure.

It is suggested that this method may be applied to mills fed by gravity feed chutes of any type. The method is also applicable (with the limitations pointed out above) to mills fed by continuous pressure feeders and to other devices.

Experiments are planned to test the theory at higher feed pressures.

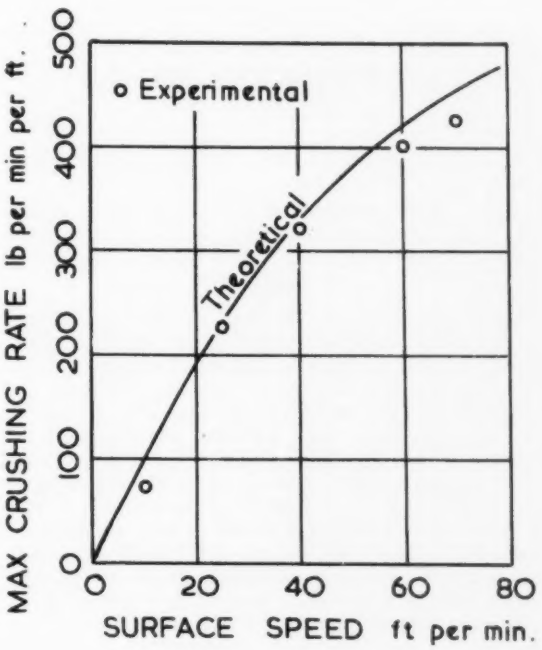

Fig. 7

ACKNOWLEDGMENTS

The author is indebted to Professor M. SHAW and Dr. K. J. BULLOCK of the Department of Mechanical Engineering, University of Queensland, for their advice and encouragement in carrying out the work

reported here; to Mr. F. P. SMITH for assistance in the experimentation, and to the Sugar Research Institute (Mackay, Queensland) for provision of the Fellowship under which the investigations are being carried out.

—— * ——

APPENDIX I

Speed = 30 ft per min

Mean Bulk Density at 7·5 lb per sq.in. = 43·2 lb per cu.ft.

Work Opening (inches)	*Max. Crushing Rate (lb per min per ft)*
0·28	150
0·42	162
0·55	176
0·69	187
0·19	139
0·18	140
0·20	139
0·25	151
0·27	152
0·31	163
0·35	185
0·43	146

APPENDIX II

Speed—30 ft per min Work opening—0·228 in.

Mean Density at 7½ lb per sq.in. (lb per cu.ft.)	d_a *(lb per cu.ft.)*	*Maximum Rate (lb per min per ft)*
58·0	46·4	250
54·5	43·6	247
54·1	43·3	251
42·0	33·6	185
46·1	36·9	212
48·1	39·3	191
51·5	41·2	228
52·5	42·0	222
61·0	48·8	244
60·3	48·3	244
57·1	45·7	248
50·0	40·0	203
55·5	44·5	226
39·4	31·6	199

APPENDIX III

BULLOCK's results for fibrated preparation

d_a = 37·0 lb per cu.ft

Work opening = 0·40 in

Speed (ft per min)	*Maximum Rate (lb per min. per ft)*
10	87·5
25	228
40	322
60	405
75	430

EXPERIENCES WITH JUICE PURIFICATION

By F. SCHNEIDER

Paper presented to the Conference of Austrian Sugar Factory Officials, Vienna, 27th June 1959.

PART I

THREE to four years ago the position of juice purification in Austrian sugar factories corresponded generally to that set by the introduction of progressive predefecation according to DEDEK and VAŠÁTKO. The predefecation was carried out in mixers by divided lime addition, the regulation of which was not dependent on the amount of raw juice, but was manually-controlled under the direction of the laboratory. Main defecation was similarly carried out in mixers, either cold or hot or with intermediate heating. Carbonatation of the limed juice was carried out mostly in individual batch tanks; only in some factories was continuous carbonatation effected, control however being manual. In one factory, it is true, fully continuous progressive predefecation had already been introduced with internal juice return. The picture of mud properties which appeared at that time (1955–56) may be demonstrated by the example of two Austrian factories in Table 1. Both factories used batch carbonatation at first. The alkalinity in predefecation in the first mixer was quite high at pH 10–10·5 and the end alkalinity in the vessel lay at pH 11·4–11·6 with 0·25–0·3% CaO, i.e. far above the optimum flocculation point in the alkaline range. A carbonatation mud resulted with a filtration coefficient between 6 and 12 (factory A). The settling rate at 1–2 cm/min was also poor. In factory B both values were even worse. We processed the same type of juice in a laboratory carbonatation vessel using a standard process (progressive predefecation, main liming, batch 1st carbonatation) under exact conditions. It was found that the end-point of predefecation was most favourable at about 0·1% CaO and pH 11.

Table 1

Carbonatation juice quality in 2 Austrian sugar factories

Factory		*1st Carbonatation (batch) Factory juice*	*1st Carbonatation (batch) Laboratory values (standard process)*	*1st Carbonatation (continuous)* Factory juice*	
A	Alk. V. S.	ca.0·300	ca.0·130	ca.0·130	ca.0·130
	F_k	6—12	5—9	6—9	3—8
	S (cm/min)	1—2	1—3	1—3	4—7
B	Alk. V. S.	ca.0·300	ca.0·130	ca.0·130	ca.0·130
	F_k	11—15	6—7	6—10	3—9
	S cm/min	1·1—1·2	1—2	1—2	4—6

* After reconstruction one year later.

After adopting these optimum values in the factories on our suggestion, the filtration coefficients improved and reached the values obtained in the laboratory. The factories then endeavoured to improve the settling and filtration properties of the muddy juices by conversion to continuous carbonatation, which, as is well-known, gives better values in this regard. Now (one year later) settling rates of 4–6 cm/min and filtration coefficients of 3–9 are being achieved.

I was asked whether it would be possible, with the same values and with Austrian beet, to change over to a continuous mud separation in decanters and rotary filters. We therefore tested the resultant raw juices from five Austrian factories with our standard juice purification method. The filtration coefficient, as a particular criterion of the muddy juices obtained, is reproduced in Table 2. It is clearly seen that the factories may be split into two groups. At factories

Table 2

Laboratory juice purification experiments

	Standard system F_k		*Braunschweig juice purification* F_k		*(S cm/min)*	
Factory	*Range*	*Average*	*Range*	*Average*	*Range*	*Average*
A	6—10	7·2	—	—	—	—
B	6—13	8·6	—	—	—	—
C	6—12	8·8	0·5—2·8	1·5	7·5—10·7	9·2
D	9—18	12·6	0·4—2·6	1·6	8·5—11·5	9·6
E	7—33	19·7	0·9—2·7	1·4	6·5—13·5	10·0

A, B and C we found filtration coefficients of about 8; at D and E they were considerably higher. On the basis of our experiences with such tests over recent years, we believe it should have been possible for the first group to change over to continuous mud separation, after adopting a modern progressive predefecation system with main liming, continuous 1st carbonatation and return of thick muds. One of these three factories has, in fact, done this successfully. The results of the second group were somewhat different. I was of the opinion that the values obtained were not quite sufficient to allow dependable operation with decanters and rotary filters. First, to consider the causes of these differences, the juice extraction in all factories was very much the same, the diffusion times were approximately the same length, and no suspicious circumstances were indicated by the diffusion temperatures. From this it may be concluded that the causes lay in the beet itself, which is reasonable as both factories lie in the north-eastern part of Austria.

In both factories, however, a changeover was made to continuous mud separation. The result was very unsatisfactory, and my predictions came roughly true. In order to be able to tell these factories whether it is possible to work successfully with another process, the Braunschweig juice purification process was simulated in factories C, D and E with the previously-mentioned laboratory carbonatation vessels. The values obtained are also reproduced in Table 2; we obtained good filtration coefficients of 1·4–1·6, as well as good settling rates of 9·2–10 cm/min. On the strength of these, I thought I could advise the factory to introduce this purification scheme. This was done last year with very good results, the laboratory values being reached in the factories.

After this summary on the juice purification processes in the Austrian sugar industry, I shall now go into the details of the Braunschweig juice purification. It is well known that this has been developed by myself and my co-workers and engineers of BMA. The factories were forced, for economic and other reasons, to rationalise, the rationalisation having automation as a prerequisite. Automation can only be carried out successfully if fully continuous processes are used. I consider it my job as a technologist to help the factories by developing such a process. Below is an operational scheme of this juice purification process, which may be split into stages. The first has the task of completely precipitating the colloids from the raw juice in reaction vessels 1a, 1b and 1c, and of promoting extensive reaction of invert sugar and non-sugars during the intermediate liming, simultaneously creating particles which settle and filter very well. This task is comparable to that effected by predefecation, main liming and 1st carbonatation. In addition the mud is separated in decanters and rotary filters. In the second part a further reaction of non-sugars and lime is carried out in an "after-liming"; during the carbonatation which follows, the juice is de-limed to the optimum and a calcium carbonate adsorption surface is formed for non-sugars.

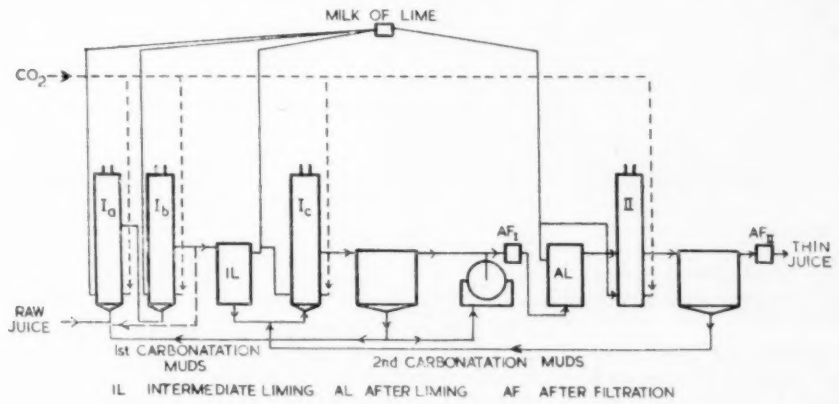

Fig. 1

In carbonatation vessels 1a and 1b defeco-saturation is carried out at lower pH values. This method of operation depends on an observation made about 6 years ago in laboratory tests: the precipitation of the juice colloids is much greater at lower pH values if a definite Ca ion concentration is set or defeco-saturation is used at these pH values.

The simultaneous action of lime and CO_2 at lower pH values has the advantage that the $CaCO_3$ and colloids form very stable agglomerates in this pH range. The colloids, well protected in this manner, are almost unattacked in the subsequent inter-liming despite the higher alkalinity, whereas the required conversion of the non-sugars does occur, particularly decomposition of the invert sugar. The possibility thus arises of treating the well-protected mud particles at higher alkalinity, without any peptization worth noting, in the classic process with main liming following straight after. This is almost impossible to effect completely, as the freshly precipitated colloids are always exposed to a direct lime effect. After inter-liming, the juice is saturated with CO_2 in the third carbonatation vessel 1c to the usual end-point of 1st carbonatation. The carbonatation vessels have been developed by the BMA engineers with the help of flow tests in full-size glass vessels and have been provided with special fixtures.

After the production of mud particles of good filtering and settling characteristics, they are separated in decanters and rotary filters. A clarifier with mechanical mud removal is used, with which a particularly high concentration can be achieved. To build up sufficiently large mud particles, thickened mud from the clarifier is returned to the raw juice. As the clarifier is additionally loaded with the returned thick mud, the amount returned is limited. Here arises the further possibility of returning muddy juice before the clarifier and before the lime action in the 1b–1a stages, and thus introducing a still greater amount of carbonate into the first reaction stage, which will not pass the inter-liming. Thus, the returned mud, which is always subject to the action of the lime, is combined with the muddy juice, which is thereby not exposed to the high alkalinity. By these means, very good settling and filtering mud particles have been produced simultaneously with heat-stable juices of good quality.

The clear juice from the clarifier and the filtrate from the rotary filters are subjected to after-filtration together. I consider this after-filtration indispensable. Nowadays, it is true, after-filtration is often dispensed with, but one is never completely safe from mud break-through, which leads to a deterioration in juice quality. It would perhaps be possible to switch over to after-filtration if a turbidity meter showed that it were necessary.

In the second stage of the process, the juice, freed from the mud containing the colloids, is subjected to an after-liming, i.e. a repeated reaction with the non-sugars by addition of a small amount of lime. This after-liming serves with the 2nd carbonatation to achieve optimum de-liming. The precipitate from 2nd carbonatation is removed in a further clarifier. This must simultaneously act as an after- and a reaction-completion vessel. The resultant mud is returned either direct to the rotary filter or to one of the reaction vessels, so that only one main filtration is necessary. The clarifier mud can be especially returned to the 2nd carbonatation reaction vessel, in order that a greater crystal surface may be added. The clear juice from the second clarifier still contains 3–5% of turbid material and must therefore be treated in an after-filter, e.g. a settling filter.

The whole process is made fully automatic by a control unit manufactured by Hartmann & Braun. It includes metering of raw juice, controlling the milk-of-lime addition by a special milk-of-lime distributor. The thick mud addition to raw juice is connected with the raw juice flow. The pH values in the carbonatation vassels are continuously measured, and the CO_2 addition is regulated by a gas pressure control. This pressure control has proved to have a favourable effect on the operation of the lime kiln. It is also expedient to install a temperature control. All these measuring and regulating devices are mounted together in a switch cabinet and are supervised by one man. This one man can attend to the clarifiers as well, once they are properly set up. Naturally it is true, as Prof. DEDEK has rightly said, that an automatic installation senses only one variable which is also controlled. Because of this, the man who supervises the juice purification plant keeps a record of continuous titrations, pH values, temperatures, etc. Over and above this, the laboratory in any well-run factory should undertake the supervision.

The experiments which have been made with this process of juice purification are indicated below.

(*a*) *Mud quality.*

In Table 3 are given the campaign averages from 5 factories, in which the starting time, which is only 3–4 days in many factories, in others somewhat longer, is not taken into consideration.

Table 3

Factory results, 1958/59 campaign

Average carbonatation juice quality

Factory	F_k	*S* (*cm/min*)	*V* %	*Thick-ening 1st carb. muds*	*Thick-ening 2nd carb. muds*	*Filter cake dry substance* %
A	1·0	13·1	13·5	1:5·2	1:33	—
B	1·5	10·5	18·5	1:5·3	1:33	55·6
C	1·3	9·2	16·2	1:3·8	—	—
D	1·1	10·0	15·0	1:5·8	1:18	56·0
E	1·2	10·1	—	1:5·3	1:7·6	57·0/54·8

In factory A an average filtration coefficient (F_k) of 1 was obtained and a settling rate (*S*) of 13·1 cm/min, in factory B an F_k of 1·5 and *S* of 10·5 cm/min. This F_k is relatively high, because of a number of difficulties caused by the combination of different

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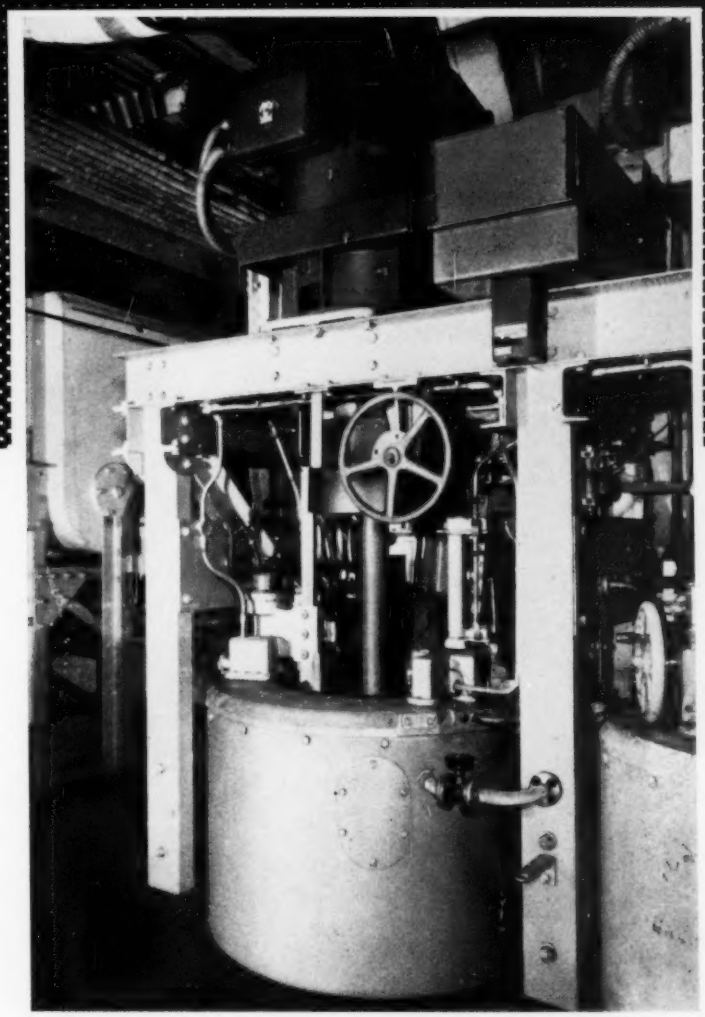

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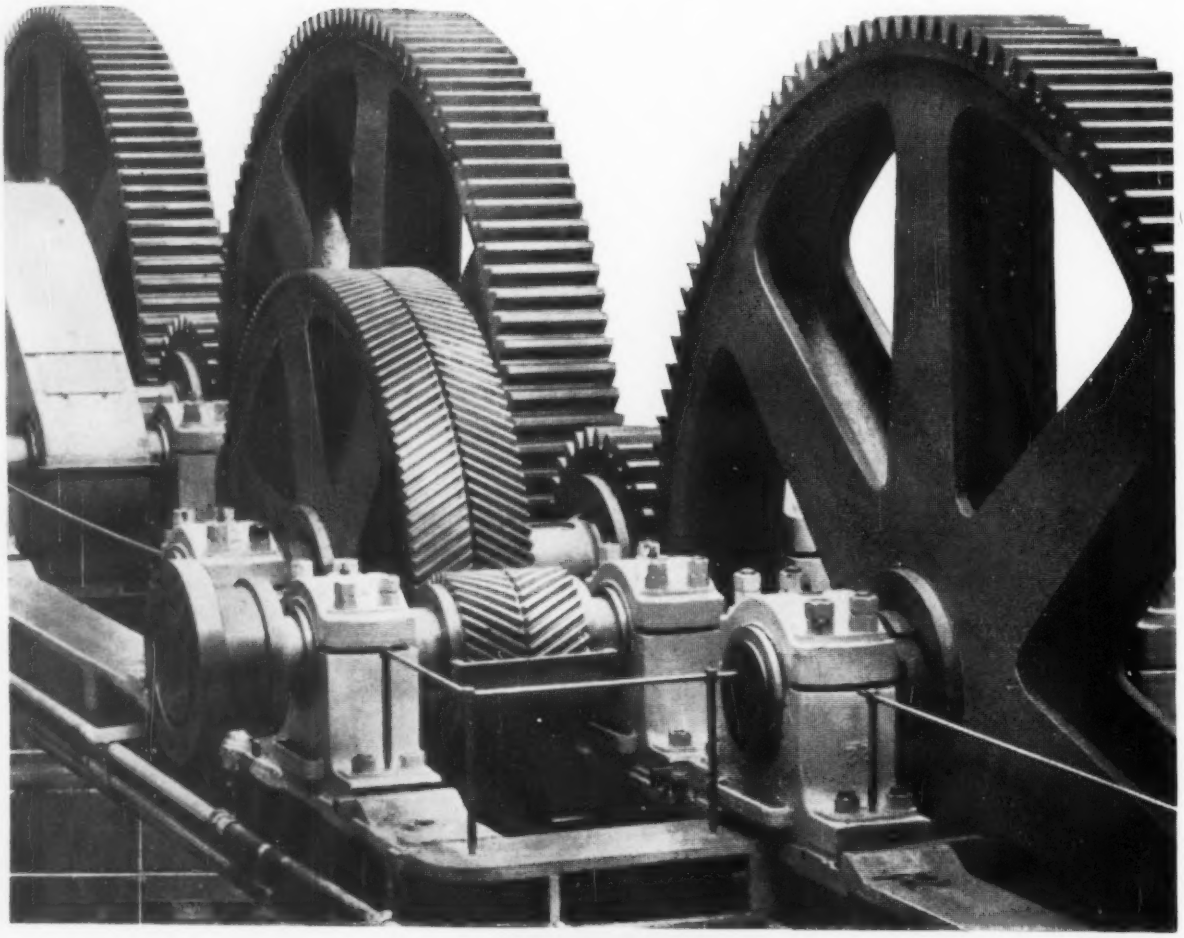

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juice extraction plant. In factory C the F_k was 1·3 and S 9·2 cm/min. This was an Austrian factory in which particularly difficult beets were processed and in which, on the basis of the experiments of the previous two years with the classic process, (pre-defecation, main liming, continuous 1st carbonatation, mud return, etc.), reasonable continuous settling and filtration could not, on the whole, be achieved. Factory D had an F_k of 1·1 and S of 10·0 cm/min, and factory E a F_k of 1·2 and S of 10·1 cm/min.

The mud volumes (V), of extreme importance in the operation of the rotary filter, lay generally between 13 and 16%, but somewhat higher in factory B, for the reasons given above. On average, the values over a wide area—in North Germany, South Germany, Austria and Yugoslavia—were reasonably uniform and generally very good.

It seems important to me to give an indication of the high degree of thickening of the 1st muddy juice in this process. The muddy juice was thickened rather well in specially developed thickeners, in a very short retention time of only 30–35 min, thanks to the high settling rate. In four factories the thickening was above 1:5, i.e. less than 20% of the mud volume was removed as thick mud. The value for the Austrian factory C was somewhat less favourable; here there were two static thickeners, apart from one mechanical, and the mud separation was not very easy, even though this factory operated with quite outstanding results.

This is a noteworthy result, which I have not seen anywhere else. It is extremely important to work with very low volumes of thickened mud. As a result of a high degree of thickening considerably less filter surface is needed for the rotary filters, and only a little juice is separated. Thus for example only one rotary filter of 20 sq.m. filter surface is needed for a daily capacity of 1500 tons, or 25 sq.m. for 2000 tons or a rotary filter of 30 sq.m. for 2400–2500 tons/day. Second, a high degree of thickening is important for thick mud return, so that the volume of the total fluid is only increased by 6–8%. If the 2nd thick mud is also returned, it is thickened in good factories in the ratio 1:30 as is seen from Table 3, the volume is increased by a further 3%, so that the total return volume is only 10% of the juice. It has been shown that with mechanical clarifiers the degree of thickening was always higher than with static clarifiers. It must be further pointed out that the dry solids content of the rotary filter muds was relatively high, between 56 and 57%. The decrease of 57·0 to 54·8 in factory E was caused by a breakdown at the vacuum pump in the second half of the campaign. Such high values are unusual for rotary filter muds, and one of these factories ventured to pile the mud into a mound after a short intermediate period of drying in which the dry solids reached 60%; this held together well. The rotary filter mud sweetens-off excellently, providing the sweetening-off water conditions are correct.

The Braunschweig juice purification system has been installed in one newly-erected South American beet sugar factory. This factory, designed for a beet slice of 1600 tons per day, achieved the guaranteed performances during 3 consecutive days 10 days after starting operations and after 60 days was processing over 2000 tons of beet daily. The values obtained are presented in Table 4. As is seen from the last column, an average filtration of 0·5, settling rate of 14·7 cm/min, and mud volume of 10·8% with thickening in the 1st muddy juice of 1:6·9 were achieved. These are excellent results; the beet have been outstanding to process. I have never seen similar results either in Germany or in Austria.

Table 4

Results of the juice purification system in a South American factory

Date	*Beet sliced (tons/day)*	*% CaO on beet*	*Carbonatation juice quality* F_k	*S(cm/min)*	V%	*Carb. juice thickening*
24.5.59	1620	1·50	0·8	14·9	11·8	1:6·8
25.5.59	1673	1·44	0·6	14·3	11·8	1:6·4
26.5.59	1681	1·42	0·8	14·9	11·3	1:5·3
Average over the first 60 days of the campaign	—	—	0·5	14·7	10·8	1:6·9

Regarding lime consumption, the lime content of the juice cannot be measured by titration of the alkalinity with defeco-saturation, but it is necessary to work with the so-called total lime titration. The difference between the total lime determination in the mixed juice (raw juice + thick mud) before 1a and after 1c gives approximately the value known as alkalinity titration, viz. between 0·9 and 1·3. This corresponds to a total lime consumption of 1·4–1·8% on beet, depending on raw juice withdrawal and further juice dilution and return. Sand is completely removed from the milk-of-lime in hydrocyclones according to a method which we worked out together with Dorr-Oliver some years ago. This sand removal is absolutely necessary in order to prevent damage to the measuring and control equipment.

(*b*) *Juice quality.*

Apart from the mud quality, extremely important in continuous separation, the quality of the juice must naturally not be forgotten. It is of course very difficult to give here absolute values or comparative values from several factories, since a number of factors lying outside the juice purification proper play a part. These include beet quality, climatic effects and juice extraction, which can be carried out under more or less sterile conditions at higher or lower temperature and with varying pH values of the fresh water.

Colour may be taken as a good indicator of juice quality. In Table 5 are given the 10-day averages of colour of unsulphitated thick juices of one Austrian factory, which uses Braunschweig juice purification. The first three 10 days gave very good results with an average of 4·5°St. After a frost at the end of Nov-

ember/beginning of December, which resulted in a certain lowering in beet quality, the colour rose to 6 or 9°St, while in mid-December it again fell to 7·8°St. Thus a very good campaign average of 6°St for 2 months was attained. Of course, it should be emphasized that the beet at this time was also very good. A sure index of quality of the beet is the invert sugar content in the press juice or in the raw juice, which with these beet was comparatively low at an average of 0·4% on 100°Bx. In two other factories the ratios were not so good. There—partly because of the not completely sterile juice extraction—0·5% and more invert sugar was found in the raw juice and the colour of the thick juice was 8·0–8·8°St. I must not hold back the fact, of course, that in another factory a colour of 11–12°St was reached. In this case there were special circumstances, however; for the processing of 2200–2400 tons of beet per day there was only one lime kiln of 47 cu.m. available, and the factory had to operate using lime bought additionally and partly with boiler flue gases, which caused great difficulty. It may be said, therefore, that with good beet, excellent juice colour is obtainable with this juice purification process.

Table 5

10-day periods	*Thick juice colour (°St, unsulphitated)*
19. 10. 58 — 24. 10. 58	4·7
25. 10. 58 — 3. 11. 58	4·6
4. 11. 58 — 13. 11. 58	4·2
14. 11. 58 — 23. 11. 58	6·0
24. 11. 58 — 3. 12. 58	9·0
4. 12. 58 — 13. 12. 58	7·8
Average (19. 10. — 13. 12. 58)	6·0

(to be continued)

THE PLAISTOW RECOVERY HOUSE

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INTRODUCTION

IN at least some of their aspects new buildings ought to be superlative. The new Recovery House at Plaistow Wharf—which houses the renewed affination, recovery (remelt), defecation, filtration and evaporator stations—is the largest, heaviest and most complicated building that my company has built. It is also the most expensive. These features, and post-war shortages, were reflected in its construction period, which started in 1949 with the clearance of a congested site alongside the existing Pan House and ended with the commissioning of the new plant throughout 1957.

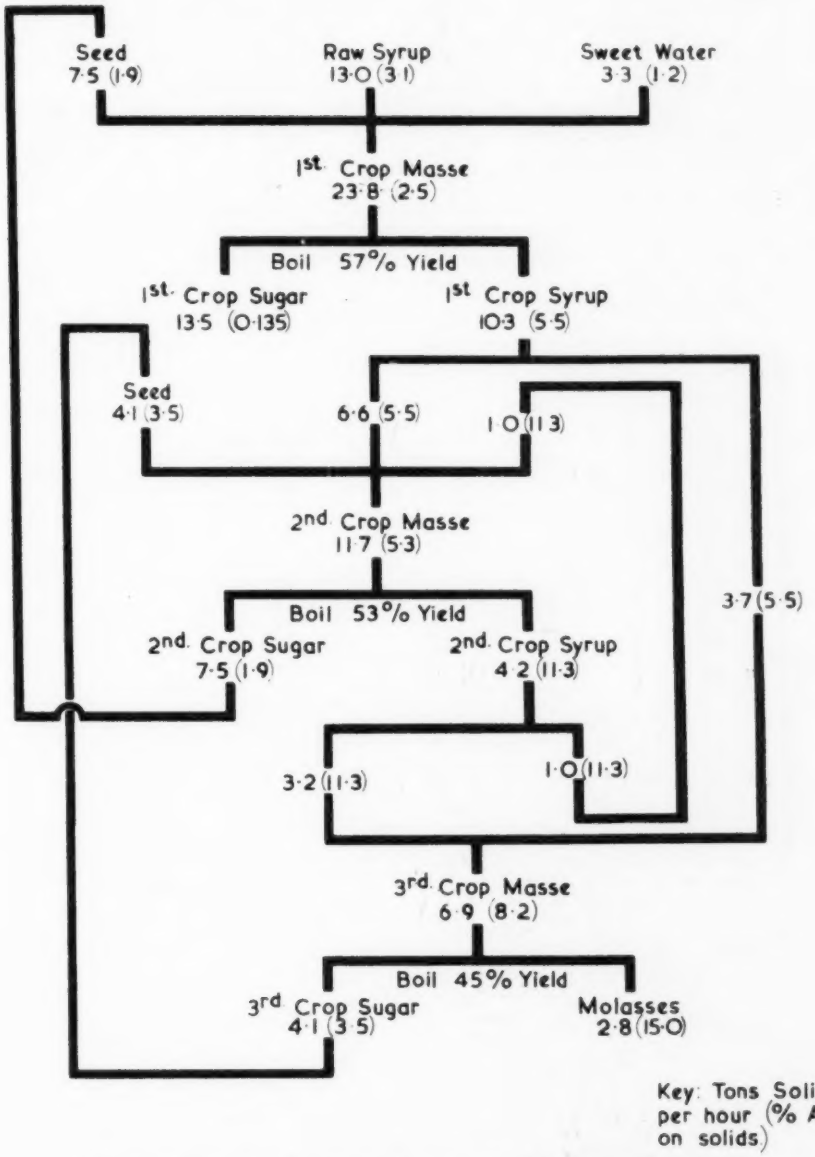
Only complete renewal of the old plant could improve it. Dirty, obsolete or worn out, housed in overloaded buildings, it could only be maintained, not renewed, where it was. Modernization required a fresh start and its scope was obvious. The affination centrifugals were obsolete and inefficient; molasses was not fully exhausted although recovery steam consumption was high; the vacuum pans were worn out and their central condensing system hindered control; recovery massecuites were unevenly reheated before spinning; we suspected, but could not measure, a substantial sugar loss in the process. Carbonatation was inadequately controlled, provided insufficient retention time and produced a filter-aid of variable porosity. In addition, small buildings and cramped plant limited melting capacity.

A new plant could remove these faults and save labour and sugar loss as well. It was therefore decided to renew all these processes in one large building to save ground area and ease supervision. It was to adjoin and connect with the Pan House, concentrating the refining process except for decolorization in one building.

DESCRIPTION OF BUILDING AND PLANT

The building is largely conventional in design but its size and site posed problems. The ground loading is 6 tons per sq. ft. and the foundation block of reinforced concrete rests on 556 piles, which have been driven through layers of ballast and clay to a pebble layer at 53 feet below ground level. These conditions caused the foundation to contribute 31% of the cost of the building. The structure is steel-framed and clad in concrete, 6 bays long by 3 wide, each 20 ft by 18 ft, with a seventh half-sized bay at one end formed by stanchions in tension hanging from cantilever beams mounted on the tops of the two adjoining rows of stanchions. Windows are provided only where men are working and the lay-out of plant allocates spaciousness and good working conditions on the same principle.

Briefly the new plant is as follows: Bulk raw sugar from store or wharf is weighed by an automatic 3-ton Servo-Balans scale and heated by mingling syrup at 72°Bx to give a magma of temperature 45°C and 10% water. Each dump of the scale impulses a doser to deliver the appropriate quantity of mingling syrup to the mingler, which provides a retention time of 3·3 minutes. The magma is spun at 830 *g* in sixteen 1100 r.p.m. Western States centrifugals driven by 100 h.p. A.C. commutator motors. Baskets are of 48 in dia. by 30 in deep with 7 in caps. A typical cycle, with a charge of 920 lb of unwashed sugar, is:



RECOVERY PROCESS SOLIDS BALANCE

Fig. 1

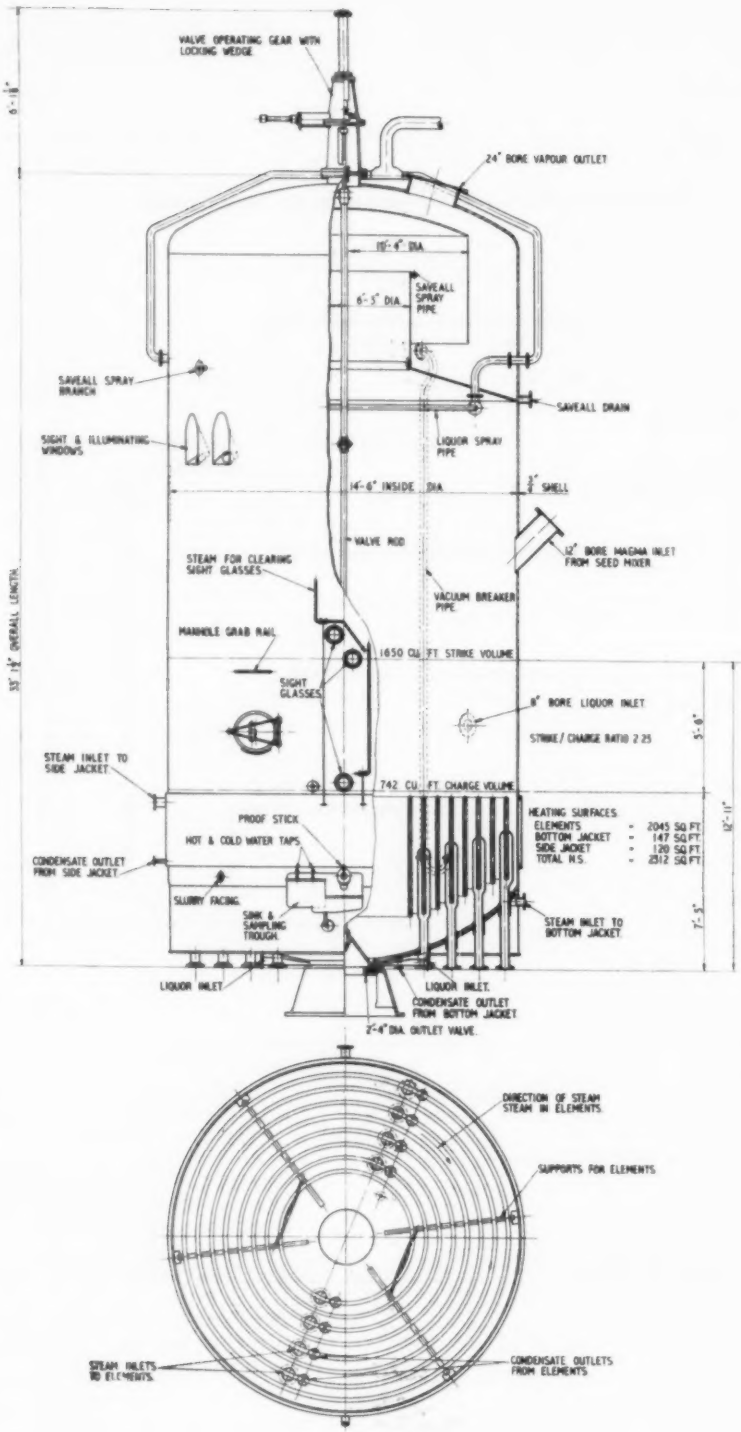
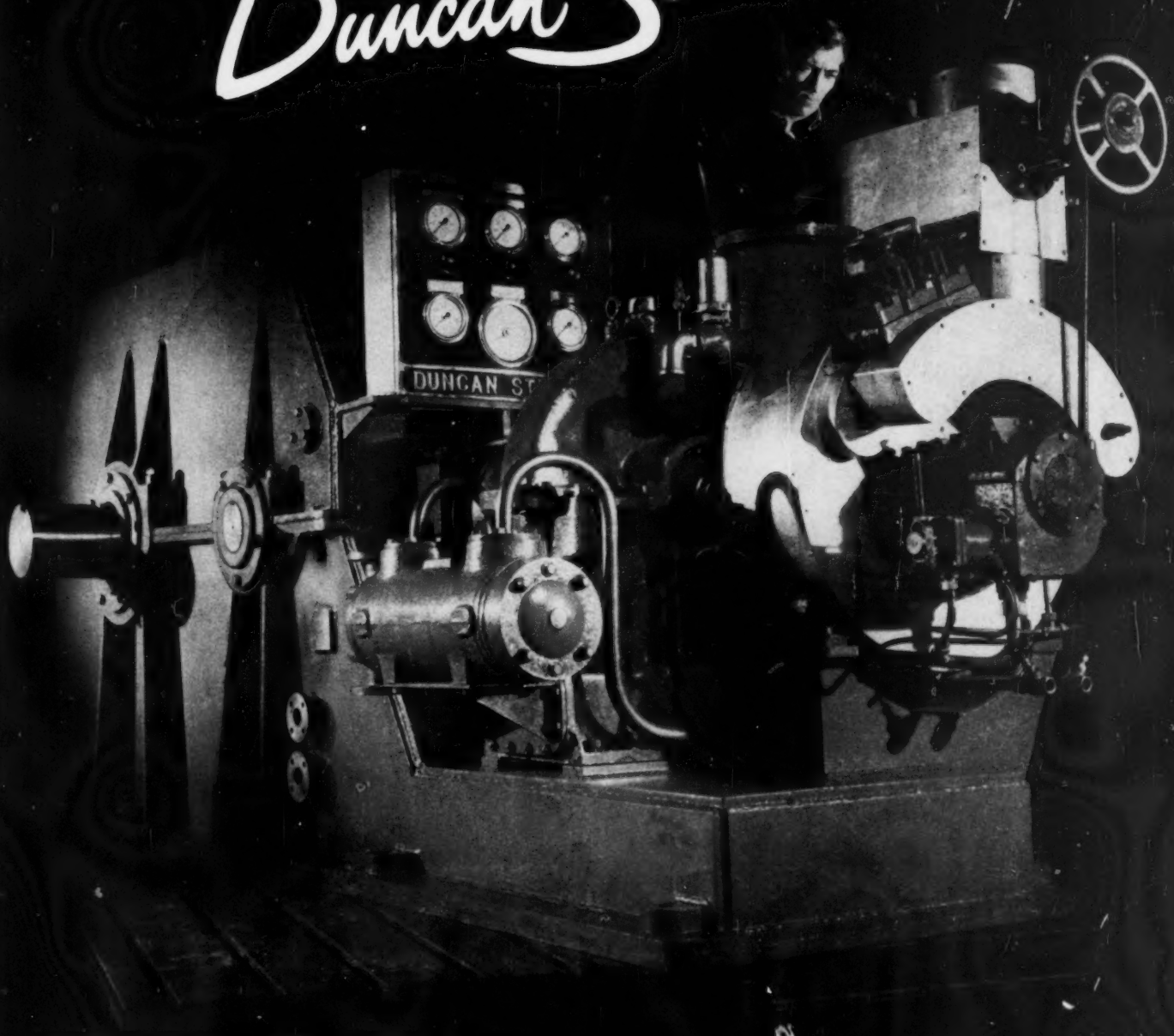

VALVE OPERATING GEAR WITH LOCKING WEDGE
24" BORE VAPOUR OUTLET
11'-4" DIA
6'-5" DIA
SAVEALL SPRAY PIPE
SAVEALL SPRAY BRANCH
SAVEALL DRAIN
SIGHT & ILLUMINATING WINDOWS
LIQUOR SPRAY PIPE
14'-6" INSIDE DIA
3/4" SHELL
VALVE ROD
12" BORE MAGMA INLET FROM SEED MIXER
STEAM FOR CLEARING SIGHT GLASSES
VACUUM BREAKER PIPE
MANHOLE GRAB RAIL
1650 CU. FT. STRIKE VOLUME
SIGHT GLASSES
8" BORE LIQUOR INLET
STRIKE / CHARGE RATIO 2.25
5'-0"
STEAM INLET TO SIDE JACKET
742 CU. FT. CHARGE VOLUME
HEATING SURFACES
ELEMENTS = 2045 SQ.FT
BOTTOM JACKET = 147 SQ.FT
SIDE JACKET = 120 SQ.FT
TOTAL H.S. = 2312 SQ.FT
12'-11"
PROOF STICK
HOT & COLD WATER TAPS
CONDENSATE OUTLET FROM SIDE JACKET
SLURRY FACING
SINK & SAMPLING TROUGH
7'-5"
STEAM INLET TO BOTTOM JACKET
LIQUOR INLET
LIQUOR INLET
CONDENSATE OUTLET FROM BOTTOM JACKET
2'-4" DIA OUTLET VALVE
33'-1½" OVERALL LENGTH
6'-11"
DIRECTION OF STEAM STEAM IN ELEMENTS
SUPPORTS FOR ELEMENTS
STEAM INLETS TO ELEMENTS
CONDENSATE OUTLETS FROM ELEMENTS

Fig. II

MILL TURBINE DRIVES

by *Duncan Stewart*



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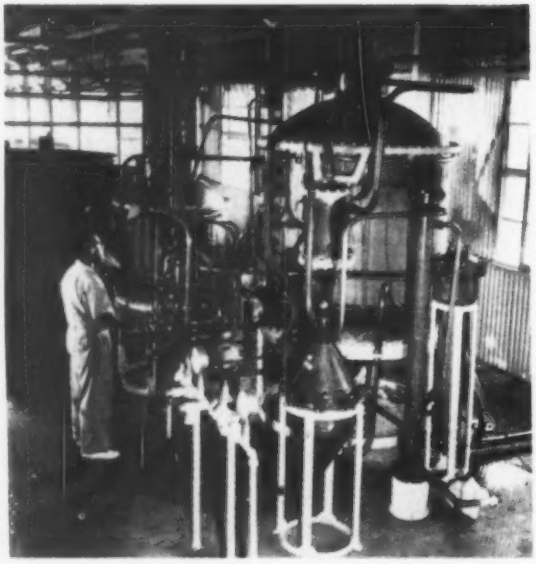

Photo. : W. NURNBERG

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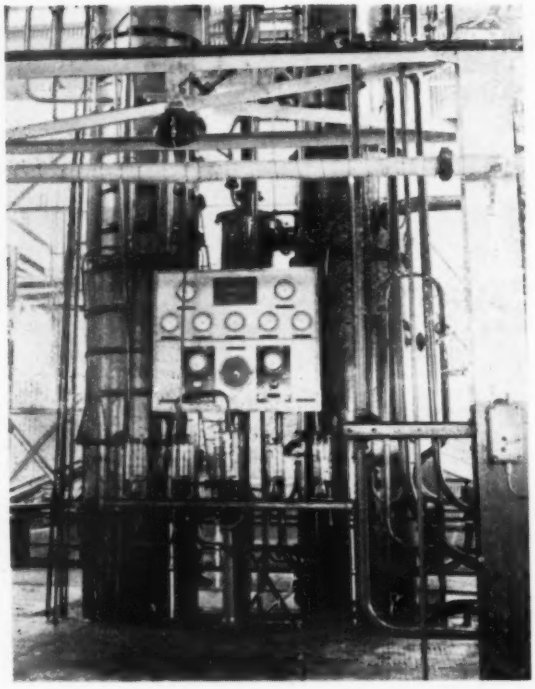
PROPAGATION APPARATUS

NEW BOOKERS' DISTILLERY AT
UITVLUGT, BRITISH GUIANA



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These centrifugals act as meters, on the one hand varying the speed of the raw sugar supply bands (which in turn speed up the weighers, which then call for more mingling syrup) and on the other controlling a "coarse" feed of water to the melter. The dry washed raw sugar is conveyed by drag scrapers, which allow visual inspection, to the melter and the resulting slurry is pumped through the "vapour melter", which is a jet condenser supplied with white sugar pan vapour. The partially melted slurry, now at 65°C, returns to the melter where steam raises its temperature to 70°C and a Kent Brix recorder/controller trims its density to 70° Bx.

Part of the raw syrup is heated to 75°C and used for mingling. The balance passes to the recovery station. This works a double-seeding boiling system, in which 1st and 2nd crops are seeded with 2nd and 3rd crop sugars respectively, with nominally 3 boilings but actually 2·7 boilings owing to footing the 3rd Crop with 1st crop syrup to assist graining. Fig. I shows the quantities involved.

There are 5 vacuum pans, the bodies constructed of welded mild steel and the save-alls of $\frac{1}{8}$ in copper; calandrias are concentric ring elements supplied with 15 p.s.i. steam. Fig. II illustrates a typical pan design. 2nd and 3rd Crop pans are fitted with 2-in bore perforated open steam coils to help circulation while graining.

1st and 2nd Crops are simply run up, the seed providing the grain. 3rd Crops are seeded with icing sugar in iso-propyl alcohol, the graining point being selected by a refractometer reading. A B.P.E. reading, read off a Micromax recorder, assesses the dropping point; 3rd Crop masses are dropped with a water content of about 5%. Belliss & Morcom two-stage air pumps provide a vacuum of 28 inches of mercury and pans can be dropped at about 62°C into water-jacketed mixers with internal chain driven stirrers. 3rd Crops average 35 hours in mixer. 2nd and 3rd Crops are reheated from about 45°C with water at 65°C in economiser-type reheaters with cast iron fins on steel tubes to within about 5°C of the saturation temperature before centrifuging, i.e. to about 62°C; these reheaters are of 2400 and 3500 sq. ft. heating surface respectively and have a heat transfer rate of 5 C.H.U./sq.ft./hour°C. All recovery centrifugals are of Western States design; they perform as follows:

Crop	*R.p.m.*	*Gravity Factor*	*% Purging Efficiency*
1st	1100	830	97·5
2nd	1500	1280	84
3rd	1700	1630	75

(Purging Efficiency is defined as non-sugars in syrup off % non-sugars in massecuite.)

In T. & L. we think the target molasses analysis can be considered a function of its invert/non-sugars ratio. Calling this "g", we think the % total sugars on molasses solids in a modern plant should approach $100\,(1{\cdot}4 + g^2)/(2{\cdot}5 + g^2)$. Plaistow's molasses is now on average about 1% TS above this standard. (We are aware of the theoretical deficiencies of this formula but have not yet found a sound substitute.) In quantity the molasses solids average about 3% melt solids.

The 1st Crop wash water is $5\frac{1}{2}$% on crystal and the analysis of the sugar approximates to that of the washed raw sugar although it is inferior in colour. It is melted separately and pumped to the raw melter.

The melter liquor is then carbonatated in 3 tanks, each of 14 ft 6 in dia. by 16 ft high. Hydrated lime, which is delivered in bulk and elevated to the top of the building pneumatically, is dosed automatically as a slurry containing 50% solids (24% CaO) into the liquor before it enters the first tank, where it is gassed out with boiler flue gases containing 11% CO_2. These gases are washed first with river water and second with soda to remove fly-ash and SO_2. The gas distributors in the tanks are multi-cruciform manifolds, perforated with $\frac{3}{8}$ in dia. holes on the undersides, and the level of liquor above them can be varied between $4\frac{1}{2}$ ft and 8 ft by changing overflow pipes. We normally work at the middle level.

Electronic Instruments Ltd. glass electrode units continuously measure the pH in the 2nd and 3rd tanks, transmitting impulses to Honeywell-Brown controller/recorders, which control the gas supply valves. 30% of the liquor flow can be recirculated from the 2nd tank to the 1st to increase carbonate crystal size but no worthwhile benefit seems to result in practice.

The carbonatated liquor is fed by gravity at 50 p.s.i. to 14 Suchar Auto-filters, each of 1280 sq. ft. filtering area. The non-productive part of their cycle is automatically controlled by Bristol timers, giving sequential control of emptying, sluicing, draining, smearing and build-up of main supply.

The sludge from the liquor presses is sweetened off in 4 Johnson plate and frame presses, each of 1535 sq. ft. filtering area. Frame size is 48 in square. The presses are closed and opened by hydraulic rams. Top cloths are silicone-treated "Neotex". The sweet water from this station is used in the raw sugar melter; it thus circulates continually but, as carbonatated liquor is already saturated with chalk, any that we add is precipitated.

(*to be continued*)

Entrainment in evaporators. F. H. GARNER, S. R. M. ELLIS and D. B. SHEARN. *Trans. Inst. Chem. Eng.*, 1959, **37**, 246–259; through *S.I.A.*, 1960, **22**, Abs. 725.—The effects of rate of evaporation (125–500 lb/hr), sugar concentration (up to 72%) and liquid level (10, 17 or 24 cm above the top of the tube plate) on the entrainment in a double-effect pilot plant evaporator were investigated. The evaporator and its control and sampling systems are described, and flow-sheets are given. Entrained sugar entering the condenser was analyzed colorimetrically in the condensate. The size distribution of the entrained droplets was determined by passing the vapour through a two-stage cascade impactor containing slides sensitized with a soft layer of MgO. The craters left by droplets which impinged on it were counted microscopically. Corrections were made for very small droplets. Results of the analysis of variance show that with low concentrations of sugar solutions (15–60%) the rate of evaporation and the liquor concentration were significant at the 5% level. First order interactions of variables (evaporation with concentrations, and evaporation with liquor level) were also significant. It is concluded that entrainment increases with concentration and rate of evaporation for the lower sugar concentrations (up to 60%). At higher concentrations, only the rate of evaporation appeared to be significant. The effects of concentration on entrainment could be attributed solely to the concomitant change in viscosity. The effect of the liquid level is not evident; the condition of the boiling surface could be an additional factor. At low rate of evaporation, changes in sugar concentration did not much affect the size of the droplets; at higher rates there was an increasing proportion of large droplets. Entrainment of material leaving the evaporator was more dependent on vapour velocity than was the entrainment entering the condenser.

* * *

The continuous centrifuge in the sugar industry, its method of operation and application possibilities. W. DIETZEL. *Bol. Azucar. Mexicano*, 1960, (May), 29–35.—See *I.S.J.*, 1960, **62**, 350.

* * *

A study of the suitability of Ukrainian kieselguhrs for the needs of the sugar industry. T. F. GORB, M. M. POLYACHENKO, I. A. PRIKHOD'KO and L. N. LUGOVAYA. *Trudy. Kiev Tekhnol. Inst. Pishch. Prom.*, 1959, **21**, 23–30.—Tests were conducted on kieselguhr samples from 10 localities in the Vinnitsa region and 10 in the Kirovograd area, 5 g being boiled during 5 min with 100 ml 20% sugar solution; after filtering, the colour was compared with that of a solution boiled without kieselguhr. The results of the investigations show that the kieselguhr is suitable as a filtering medium after elutriation and roasting for 1½—2 hr at 600–800°C.

* * *

A study of the heat exchange and hydrodynamics during boiling of high concentration sugar solutions. I. I. SAGAN'. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1959, **21**, 31–39.—Tests were carried out in an experimental vertical single-tube evaporator (with removable tube) included in a circuit with a secondary-steam chamber and a circulation tube[1]. Sugar solutions of 60–86% solids content were boiled under pressures of 0·4–1·0 atm. in steel tubes of 150–159, 87–95 and 48–57 mm dia and a copper tube of 87–95 mm dia. The results using the 87–95 mm dia. copper tube are used to prepare a graph of heat transfer coefficient *vs.* heat flow. The resultant straight lines have an angle of slope with a tangent approximate to 0·6. Thus, with increase in the concentration, the heat transfer coefficient falls and the viscosity increases as a result. The results are in agreement with those obtained when boiling low concentration solutions in small bore tubes.

* * *

Installation for investigation of hydraulic resistances of pipelines during flow of viscous fluids. Z. S. SHLIPCHENKO. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1959, **21**, 41–46.—Theoretical equations are presented for the expression of pressure drop in pipelines, and an experimental installation described for determination of the values of the non-dimensional coefficient of friction throughout the pipe length based on the effect of flow and wall roughness on the pressure drop, and non-dimensional coefficient of resistance, based on the dynamic properties of the fluid and flow conditions. A molasses solution was heated in a tank to a pre-determined temperature, then pumped through a pipeline continuously to heat it, returning through the end to the circuit to the tank. When the temperature of the solution passing into the tank was identical with that flowing out, the solution was pumped through the same circuit but ending in a weigh tank. Two cylinders attached at identical distances from the ends of the straight tube were connected to a differential manometer. A timing device indicated the end of the test, when a certain pre-determined weight of fluid was registered by balancing of the weigh beam.

[1] *See* SAGAN': *I.S.J.*, 1959, **61**, 371.

The time of acceleration of a centrifugal basket. K. A. BORTNOVSKII. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1959, **21**, 47–55.—Theoretical formulae are presented for calculation of the time of acceleration of a centrifugal basket based on the effects of (1) time required for engagement of the centrifugal clutch covering the acceleration of the basket from zero to a speed corresponding to the angular velocity of the clutch driving parts when engaged, and (2) the time of acceleration of the basket with the clutch engaged, until constant speed is attained.

* * *

The solvent process for the manufacture of sugar. K. S. RAU. *Indian Sugar*, 1960, **10**, 205–214.—In the scheme described in Indian Patent 60,403, butyl alcohol is added to raw juice (5–10% on juice volume), which is then heated during 7–10 min to 80°C on a hot water bath and cooled; three layers become apparent, the bottom one—purified juice from which impurities have been extracted—containing almost all the original sucrose. If stale cane is used, the top layer too will contain some sucrose. The sucrose may be recovered by means of pan boiling or by precipitation with added acetone. The advantages and disadvantages of the latter scheme are discussed.

* * *

Ion exchange in sugar refining. ANON. *Rohm & Haas Reporter*, 1960, **18**, (2), 4–8.—Details are given of the processes used at the two refineries of the American Molasses Company, including affination and re-melting of the incoming raw sugar and demineralization, and decolorization by means of a mixed bed of "Amberlite 401 S" anion exchanger in chloride form and "Amberlite IR 120" cation exchange resin in sodium form. Evaporation and pan boiling are also described.

* * *

The use of gamma radiation in the weighing of bagasse. G. O. BURR, G. E. SLOANE and G. T. FURMIDGE. *Hawaiian Planters' Record*, 1960, **55**, 271–283.—Full details are given of the bagasse weigher[1], which uses ^{137}Ce gamma-radiation for measurement to within a total error of ± 0.7% average bagasse flow (0.35% on full scale). The principle is that of a Wheatstone bridge circuit, the signal output from the balancing chamber exceeding that from the weighing chamber and a fixed signal being subtracted from the total signal to give a difference signal measured at very high sensitivity. With a single ionization chamber (such a system has yet to be tested) the same principle is applied as with the double-chamber, but the fixed signal is subtracted towards the end of the measurement rather than at the start, i.e. at the potentiometer transmitter, and the difference signal further amplified.

Electrolytic method of purifying juice. CH. SHU-GUN. *Sakhar. Prom.*, 1960, (9), 17–19.—A modification of the Ghosh clarification system[2] is described, whereby cane juice is passed through a vessel containing iron or aluminium plates 1 cm apart acting as electrodes. The juice is heated to 75°C, electrolysed to pH 7, limed to pH 8·5, heated to 65°C, filtered, Ca phosphate added, the juice heated to 100°C, then finally filtered. The juice purity increase is of the order of 5%, 38% of the original colloids being precipitated and the colour lowered by 94%; 0·04–0·08% iron is consumed on weight of cane, 0·04–0·05% CaO and 0·5% Ca phosphate. The major defect is a 10% increase in the invert content, which makes the process unsuitable for the beet industry.

* * *

The nature of non-sucrose sugars in cane sugar production. I. F. ZELIKMAN and T. R. ABDURASHIDOV. *Sakhar. Prom.*, 1960, (9), 19–22.—Graphs and tabulated data are presented to demonstrate the different effects of reducing substances on the saturation coefficient of aqueous cane and beet sugar solutions. Comparison is drawn between the binding of water in the hydrated molecules of the reducing substances, reducing the amount available for solution of sucrose, and thus increasing the recovery, and the effect of invert sugar, itself a decomposition product of sucrose, on the beet sugar solution, the viscosity and colour of which are raised under alkaline conditions. As the Brix of cane syrup is lower than that of a beet syrup having an identical proportion of non-sugars, temperature, and supersaturation coefficient, the viscosity is lower and sugar boiling and curing conditions better. It is shown that a cane product of 50·2–56·8 purity has a crystallization rate just slightly less than that of a beet product of 73·5–87 purity. Thus, with combined processing of cane and beet sugar it is considered possible to lower the molasses purity and increase sugar recovery, mixing the cane raw sugar with 2nd product yellow sugar (not final product) in a 3- or 4-boiling scheme.

* * *

Parallel processing of massecuite products in the refinery. V. YA. BRAGINSKII and B. G. NERUBAL'-SHCHUK. *Sakhar. Prom.*, 1960, (9), 31–32.—At Odessa refinery large lump and 1st small lump massecuites were formerly spun one after the other in the same centrifugals; the sugar then passed via screw conveyors and elevator to the minglers. This scheme has been replaced by one in which the large lump, 1st and 2nd small lump, massecuites are spun in separate groups of centrifugals and dropped directly into the hoppers above the minglers. Losses have been cut and boiling accelerated.

* * *

White sugar automatic centrifugal of Polish design. T. KOWALCZYK. *Gaz. Cukr.*, 1960, **62**, 209–211.—Some details with a diagram are given of a "Rekord" centrifugal, which operates at a maximum speed of

[1] *See I.S.J.*, 1955, **57**, 130; 1957, **59**, 251.
[2] *I.S.J.*, 1957, **59**, 73.

960 r.p.m. and has a cycle of 3–8 minutes. The 125 cm diameter basket is very slightly conical. Charging and washing are automatic, with one operator controlling 4–5 machines. Tests have shown that the cured sugar is comparable in quality to that from manually-controlled machines and has a colour equal to the best obtained in the factory.

* * *

Mechanical washer for (pressed sugar) dryer trays. YA. O KRAVETS. *Sakhar. Prom.*, 1960, (9), 33–34.—The washer comprises a drum revolving in a water bath under the weight of 5–6 trays attached to each of four cages. The trays are loaded and unloaded manually on diametrically opposite sides of the drum.

* * *

Methods of reducing process losses. A. G. KELLER. *Proc. 18th Ann. Meeting, Hawaiian Sugar Tech.*, 1959, 13–16.—Causes of factory losses and their reduction are discussed. Methods of increasing sugar recovery are enumerated; these include attention to mill condition and performance, reduction of micro-organism activity at the mills, use of cane diffusion and bagasse screw presses, shorter retention in clarifiers by adoption of improved feed inlets, use of polyelectrolytes as flocculants, and of the Eimco "RotoBelt" filter, and elimination of entrainment by lengthening the vapour space and installing wire mesh separators.

* * *

Raw sugar quality as viewed by the factory operator. W. KENDA. *Proc. 18th Ann. Meeting, Hawaiian Sugar Tech.*, 1959, 25–29.—The factors affecting raw sugar quality criteria, viz. grain size and uniformity, filtrability, crystal colour, ash content and polarization, are discussed in relation to factory techniques. A study programme introduced by C. Brewer & Co. Ltd. in their factories includes recrystallization, melting, highly coloured low-grade sugar in clarified juice and syrup, testing the effects of sodium hydrosulphite and "Hodag CB" on crystal colour and of "Keltex" and "Calgon" in clarification, and examination of the relation between massecuite purity and crystal colour and filtration rate, as well as the effect of using low grade seed as compared with ball mill slurry.

* * *

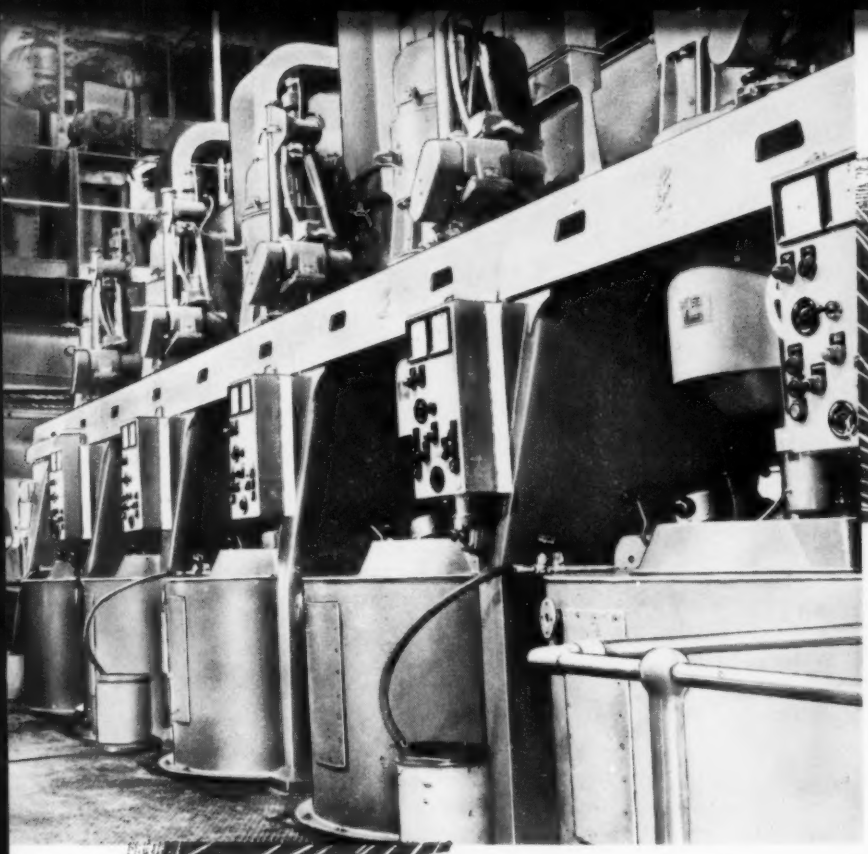
Milling studies at Hawaiian Commercial and Sugar Company Ltd. 1959. W. S. HAINES. *Proc. 18th Ann. Meeting, Hawaiian Sugar Tech.*, 1959, 90–95.—After checking the reproducibility of sampling and analytical procedures, maceration tests were carried out on the 4-mill "B" tandem at Puunene. The difference between the pol % juice from individual mills and the pol % non-fibre of the bagasse leaving them indicated the poor degree of mixing of maceration with the juice in the bagasse. Comparison of hot maceration at 170°F with cold maceration at 78°F showed that the former was more effective. Maceration liquid applied to the blanket fed to the last mill gave higher extraction than when a third of it was applied before the third mill, although the high degree of variation in the extraction figures from test to test make the significance of this difference doubtful. Increasing the mill speeds allowed increased maceration without causing mill chokes. The increased amount of water at the last mill caused higher pol extraction, which offset any decrease in the last mill juice purity. Moderate pressure feeding applied before each of the last three mills might improve extraction.

* * *

An introduction to pH control effects on processing sugar cane products. L. J. RHODES. *Proc. 18th Ann. Meeting, Hawaiian Sugar Tech.*, 1959, 96–99.—A review is given of the effect of pH on sucrose inversion, clarification, scaling, viscosity, colour and crystallization. Recommendations are offered; these include: a minimum syrup pH of 6 to avoid inversion, with processing at low temperature; optimum clarification pH to be determined under varying conditions; avoidance of over-liming to reduce scale; avoidance of high pH when processing low-grade products to reduce viscosity; and use of lower pH values to reduce colour.

* * *

Clarification seminar. N. J. SAXBY, E. L. LUI, J. HERKES and D. G. CONKLIN. *Proc. 18th Ann. Meeting, Hawaiian Sugar Tech.*, 1959, 102–106.—Reports are presented on the use of different clarification agents tested at various Hawaiian factories. At Hutchinson Sugar Co. MgO increased juice turbidity, reduced mud settling, caused some fouling of filter screens, and gave a higher sugar crystal colour with slightly poorer filtration rates. However, scale in the 4th evaporator effect was easily removed by boiling-out with NaOH. Mixed with lime (1–6 parts MgO to 10 parts lime), the oxide caused a turbidity increase when used in the higher proportions, but caused lower scaling, and *vice versa*. "Separan AP 30" was found more effective than "Separan NP 10" in reducing turbidity. With the use of 10 parts lime to 3 parts MgO and 2–4 p.p.m. "Separan", the cost of clarifying one ton of sugar is slightly higher than with conventional liming, although clarification is better and more rapid, evaporator capacity is increased, the evaporator cleaning costs cut, and pan capacity increased with regular syrup densities. At Olokele the picture was more or less the same, the amount of MgO used being dependent on the juice pH, as beyond pH 6·1 no improvement in clarity was possible. Ammonium hydroxide at Kahuku gave fairly good clarification, with mud settling well; the juice clarity was poorer than that of juice clarified with lime. It was difficult to maintain a high pH of clarified juice and syrup, and ammonia was found in increasing amounts in the boiler feed water. At Koloa use of 100% MgO also permitted higher % maceration in the milling train and thus higher pol extraction. MgO is added to the juice to give a pH of 7·3, which gives a syrup pH of 6·6. Although cheap, dolomite containing 58·9% CaO and 38·4% MgO did not prevent bad scaling of the evaporators, even when MgO was added sufficient to reduce the CaO% to 6. Analysis of evaporator scale showed it to be mainly Ca sulphate.



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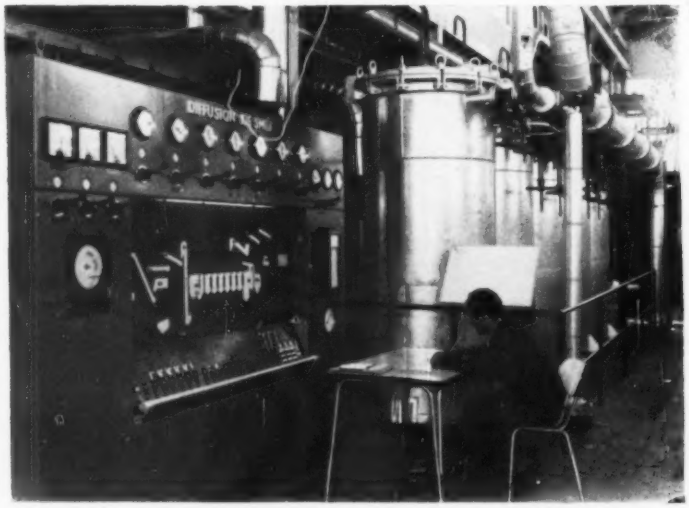

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BEET FACTORY NOTES

Results of pilot-plant experiments with a new beet storage method. S. VAJNA. *Zeitsch. Zuckerind.*, 1960, **85**, 401–410.—Beet were stored in clamps covered with tarpaulins or plastic sheets for 135 days during the 1958/59 campaign and 30 days during the 1959/60 campaign. The beet were mechanically ventilated, the inside temperature being 2–6°C lower than ambient. Daily sugar losses were 0·006–0·008% and total daily weight losses 0·03%. The beet had the same turgor at the end of the storage period as at the start. In the 1958/59 campaign withered beet were stored, and thus exposed to strong infection, although the temperature could still be maintained at the above-mentioned level, despite sharp frosts and high daily temperatures. In the 1959/60 test healthy beet were stored and suffered no ill effects. The heat flow coefficients were determined and the coldness losses calculated for industrial-size clamps. The results were better than with a control pile, the specific surface of the clamp being much smaller at 0·4 sq.m./ton for 10,000 tons compared with 1·75 sq.m./ton. About 80% of the cold air produced by the refrigerating machine should be used to keep the beet temperature down and only 20% to compensate for the cold lost at the clamp surface.

* * *

Some thoughts on juice purification. M. ATHENSTEDT. *Zeitsch. Zuckerind.*, 1960, **85**, 417–418.—Improvements in juice purification depend on a number of factors. Included among these are suitable heating of the juice before the clarifiers (to avoid inefficient settling); heating of the muddy juice to a temperature above 90°C will cause juice coloration in the settlers. The settlers should have such dimensions that the juice can be retained for a considerable time at 85°C. The first muddy juice or thickened clarifier muds should be processed as carefully as possible; both juice and muds should leave the settlers and filters under gravity. After defeco-saturation the juice should have a pH of 12. Controls, particularly of pH, are discussed.

* * *

Extraction of sugar from beets. I. T. SIMIZU, H. KOZIMA and H. HABE. *Sci. Rpts. Hyogo Univ. Agric., Ser. Agric. Chem.*, 1959, **4**, 56–60; through *S.I.A.*, 1960, **22**, Abs. 716.—Sugar extraction is resolved into two steps of mass transfer: (1) diffusion of sugar through the permeable membrane of the beet cell towards the interface of the beet and extracting solution, and (2) the mass transfer of sugar through the boundary film of liquid into the extracting solution. Diffusion coefficients in (1) were measured as between 0·00001 and 0·00005 sq.cm./sec. In regard to (2), the overall mass transfer coefficient was considered. With a large extracting area per unit weight of beet, the flow rate of the extracting liquid affected the results considerably, so that resistance to mass transfer through the solid-liquid interface was important.

Sugar factory without lime kiln. L. HUTZL. *Zeitsch. Zuckerind.*, 1960, **85**, 420–422.—The effect of the Chilean earthquake in May 1960 on the three beet factories, which were processing beet at the time, is described. Linares and Los Angeles suffered little damage, and had completed 105 and 98 days' respective production, with a daily slices of 1710 and 1770 respectively by 10th July. The lime kiln at Llanquihue was destroyed, but otherwise little damage was sustained by the factory. (Processing at Llanquihue started on 12th May, because of the small beet harvest.) To burn the limestone 3 "chonchons" were made, i.e. a pile similar to that used by charcoal burners, and by this means 8 tons of lime produced daily. This was sufficient, however, to process only 1000 tons of beet, so that the daily processing fell from 1170 to 910 tons of beet. Despite the small lime addition, but because of the high SO_2 usage, carbonatation was satisfactory and the juice clear. Two new lime kilns are being built.

* * *

The conversion to standard molasses of the true sugar content of final molasses. L. S. TVERDOKHLEBOV. *Sakhar. Prom.*, 1960, (8), 9–10.—The difference between the sugar content of final molasses and the value converted to that of standard molasses will indicate the amount of sugar lost in molasses over that which would be lost with efficient exhaustion. The method of calculation laid down in the official instructions gives incorrect results, and an alternative method is suggested.

* * *

Prospects of using nylon in the equipment of sugar factories. G. A. PREIS and N. A. SOLOGUB. *Sakhar. Prom.*, 1960, (8), 12–16.—The application of nylon in the manufacture of bushes, bearings, valve seatings, etc. is discussed.

* * *

The RDA-57 rotary diffuser. S. V. TSVETSINSKII. *Sakhar. Prom.*, 1960, (8), 22–24.—The RDA-57 rotary drum diffuser is 5 m in dia. and has a daily capacity of 1500 tons beet. It has 30 cells with a rotary screen device at the head. Although it has a number of advantages over the Sangerhausen double-scroll diffuser, the RDA has revealed several constructional defects, which are enumerated.

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Choice of conveyors in automatic control of beet knife capacity. V. N. SHCHEGOLEV. *Sakhar. Prom.*, 1960, (8), 28–32.—To ensure regular cossette feeding to diffusers, the beet knives should be of variable speed, automatically controlled; the scalder should not be placed directly beneath the knives; rake conveyors should not be used; the number of intermediate conveyors should be cut; and belt conveyors with weighers should be placed directly below the knives.

Experience in the work of L'gov sugar factory. E. D. ZINCHENKO. *Sakhar. Prom.*, 1960, (8), 38–41.—Details are given of the modifications introduced at L'gov sugar factory in the form of new and modernized equipment. These have enabled the factory to exceed the planned annual sugar production, save fuel, shorten the campaign and reduce production costs.

* * *

From the experience of Novo-Tavolzhan sugar factory in increasing daily capacity. A. Z. MEDVEDEV *Sakhar. Prom.*, 1960, (8), 41–45.—Alterations made to the system of beet feeding to the washers from the flumes are described and an account is given of modifications to the predefecation vessel, in which the juice and returned muds feed ports were arranged tangentially and baffles arranged alternately at the sides to increase the mixing. The jet sprayers on the vacuum filters were placed in the bottom of the water feed pipes and at the sides, to prevent stoppages by muds.

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The efficiency of different methods of predefecation. K. D. ZHURA. *Trudy Kiev. Tekhnol. Inst. Pishch. Prom.*, 1959, **21**, 11–21.—Details are given of laboratory tests on hot and cold progressive and non-progressive pre-liming with return of oversaturated and under-saturated juice. With fresh beet the maximum precipitation of colloids and filtration rates were achieved with 5-min progressive predefecation with 100% return of under-saturated juice limed to 0·4–0·45% CaO. Non-progressive preliming with return of under-saturated juice led to peptization of a large part of the colloids and poorer filtering properties. With return of filtered juice as above, the colour of the juice was lower than with return of unfiltered juice, caused by the partial dissolving of non-sugars from muds contained in the latter. Pre-liming with 200% return of normally saturated 1st carbonatation juice and optimum lime consumption causes a sharp rise in the filtration rate, both with progressive and non-progressive predefecation. Progressive pre-liming led to a smaller amount of colloids in the 1st carbonatation juice with 200% return of undersaturated juice than with non-progressive pre-liming, while with 200% saturated juice return the amount was higher, despite 10-min mixing, and the juice colour higher. With higher quality raw juice, 3-min progressive preliming with 100% return of under-saturated juice at 0·45% CaO alkalinity gave slightly higher filtration rates than 3-min progressive preliming with 100% return of oversaturated juice at 0·02% CaO alkalinity. The settling rates were identical. Hot progressive predefecation with under-saturated juice was more effective than cold preliming.

* * *

Sugar beet storage under the influence of naturally or artificially produced cold and the effect thereof on the sugar content. E. GRÖSCHNER and O. HAMANN. *Nahrung*, 1959, **3**, 259–269; through *S.I.A.*, 1960, **22**, Abs. 560.—The storage of beet at low temperatures has been investigated in regard to the possibility of extending the campaign. Beets were stored at –2·5, –5 and –16°C and at 85% humidity. With cooling at –2·5°C there were rapidly increasing sucrose losses and increasing invert sugar concentration after four months. Storage at –5°C greatly reduced the sugar losses, but mould growth could still be observed. At –16°C the beet were completely frozen. The sucrose and invert sugar contents remained practically constant. Dry content in all cases increased slowly owing to respiration and evaporation. Cossettes stored at –16°C showed the same results. Some losses occur after thawing before processing. Raw juice analyses of beet after cold storage and of fresh beet are compared, and these show only slight differences. A storage temperature of at least –8 to –10°C is advised. A technical realization of the process is however still problematical.

* * *

Continuous diffusion. F. SCHNEIDER and E. REINEFELD. *Zucker*, 1960, **13**, 460–471.—A detailed review is presented of the various types of beet diffusers now used. These include: the RT, de Smet, Olier, Oppermann & Deichmann, J, BMA, Buckau-Wolf and DdS diffusers. Comparison is drawn between the operational principles, the extraction efficiency, retention time, effect of heat on the cossettes, temperature of the raw juice obtained, size and surface area of the diffusers, calculated on the beet capacity.

* * *

Device for determining the optimum coefficient of supersaturation during massecuite boiling. V. D. POPOV and I. G. BAZHAL. *Sakhar. Prom.*, 1960, (9), 14–17.—The instrument consists of two vertical tubes housed in the pan, one on each side and extending from the massecuite space into the vapour space. The bottom of each tube contains an electrode and a filter screen; the electrodes are inter-connected through a normal bridge circuit to a logometer. The sieve in one tube is finer than in the other, so that even fine crystal will only pass through that of the opposite tube. A reading is given of the ratio of the resistances of the massecuite in the tubes; in the absence of false grain the resistances in both tubes will be identical, with the result that the bridge will be in equilibrium and the indicator will give zero reading. As soon as false grain forms, the reading will tend away from zero, the pan-man feeds more syrup and dissolves the false grain. The grain in the tube is frequently blown through into the vapour space by a blast of air.

* * *

The relative density of beet cossettes and diffusion juice in diffusers. S. M. GREBENYUK. *Sakhar. Prom.*, 1960, (9), 22–28.—Tests carried out to determine the density of diffusion juice and beet cossettes are described, using pre-weighed cossettes and tared vessels of known volume. Determinations were made for both battery and rotary continuous diffusers, and the results expressed in graph form and tabulated.

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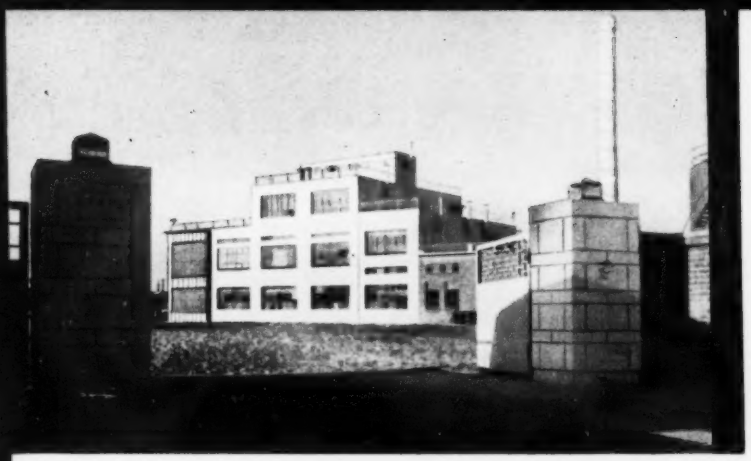
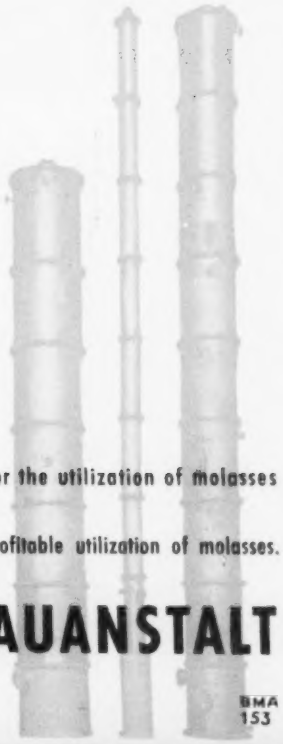
active dry baker's yeast (saccharomyces)	In granules 92 % dry substance can be stored without losing its baking power
Baker's yeast (saccharomyces)	28 % dry substance
Nutrient yeast (torulopsis)	For human consumption high protein and vitamin content used as substitute for meat
fodder yeast (torulopsis)	Used as additive to animal fodder with high protein and vitamin content





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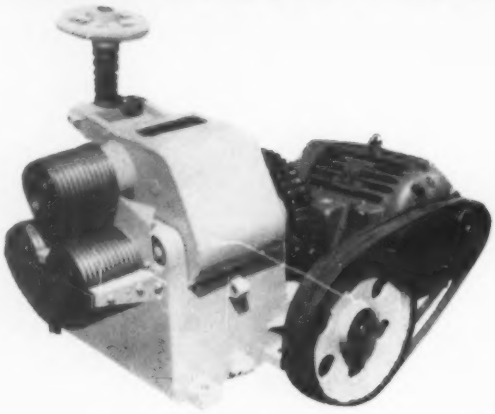
Suma Products

CANE AND BAGASSE ANALYSIS



Our **ROLEX** laboratory three-roller mill is provided with 5 in. × 5 in. rollers of Meehanite cast iron, while the spur gears and casting which carries the adjustable top roller are of steel. This top roller is fitted with a compression spring while scrapers are provided for both bottom rollers Oilite bearings are fitted, and the juice tray and scrapers are removable for cleaning. The illustration shows a **ROLEX** mill belt-driven by a 3 h.p. electric motor.

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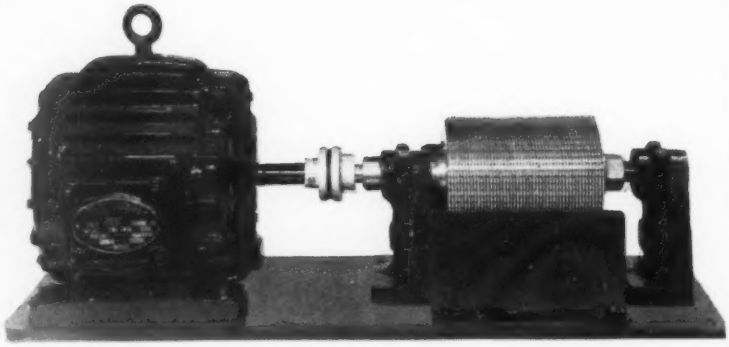
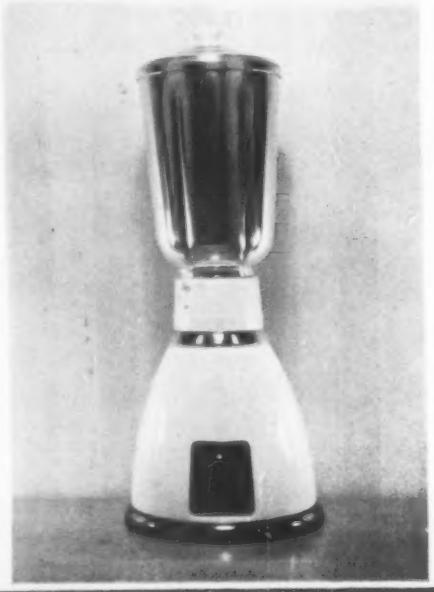
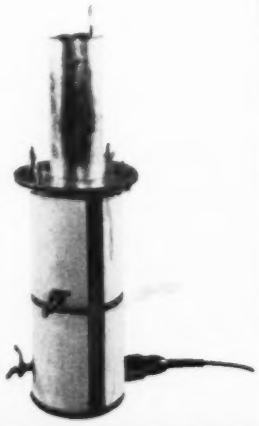




Our high-speed mixer for analysis of fibre in bagasse has knives of improved design with two speeds of 7000 and 14,000 r.p.m. and a special feeder-type lid to prevent spillage. Its metal goblet is of 2000 ml. capacity. It is provided with a motor designed to take only single-phase A.C.

Our hot water digester for determination of the sucrose lost in bagasse, electrically heated, for 500 grm. samples.



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The volume of air and gases accumulated in the battery processing healthy beet amounted to 15–55 litres/cu.m. diffuser space, depending on the cell. In the case of frozen beet, the amount was 34–87 litres/cu.m. The coefficient of utilization of the diffuser volume was thus reduced to 91–99·5%. In the tail and head cells of the battery the densities of juice and cossettes were identical; in the remaining cells the juice density was greater. In the rotary diffuser the cossettes were lighter at the head and tail, and the densities identical in other parts of the diffuser.

* * *

A scheme for heating black liquor (in the Steffen process). V. I. CHOPIK. *Sakhar. Prom.*, 1960, (9), 29–30.—Instead of using large amounts of exhaust steam to heat the black liquor cold saccharate from 15 to 85–90°C, whereby up to 5% on weight of beet of condensate is lost (i.e. 3 tons of hot condensate/hr in a 1500 ton factory), hot barometric condenser and ammoniacal water should be used as well as vapours from the 2nd evaporator effect (at 115°C). Steam consumption may thus be cut by 2·5% on weight of beet. Equations are presented for heat transfer calculations.

* * *

Beet washer KMZ-57. G. A. KANIVETS. *Sakhar. Prom.*, 1960, (9), 44–46.—A modified version of the Dobrovol'sk beet washer previously described[1] includes special sand and stone traps, which open hydraulically and close under the action of a counterbalance, and a screw, attached to the main shaft, which creates an upward current of water and allows foreign matter lighter than water to fall into a trap beneath. The modifications have been necessitated by mechanical harvesting and the processing of very dirty beet.

* * *

Automatic density meter for sugar syrup. E. S. ZAKREVSKII. *Sakhar. Prom.*, 1960, (9), 38–44.—The instrument consists of a float chamber in which are located two floats, one inside the other. Each end of the outer float is extended in the shape of a tube. The bottom tube is closed, while the upper tube extends beyond the lid of the float chamber and ends in an overflow. The inner float has an open-ended tube passing through its axis, housed within the tube of the outer float and surmounted by a funnel. Water is poured into this funnel, passes through the tube into the outer float around the inner float which contains air. The level in the funnel is constant, any excess water passing back up the tube of the outer float and out through the overflow, into a drip catcher. Syrup is fed from both sides of an annular chamber around the outer float chamber. The syrup heats the water circulating in the float, and as the temperature of the water rises its density falls, changing the position of the inner float relative to the outer, while the position of the outer float depends on the syrup density. The floats are connected by a lever system to a prism balance arm, to which is also connected the lever transmitting the position of the outer float to a recording device, the inner float position correcting for temperature. Density of the syrup is recorded and may be controlled to within 0·1°Bx. Full details are given of the syrup feed control and density controls with a wiring diagram.

* * *

Prototype of centrifugal beet slicer of 1700 mm diameter. C. JUDASZ. *Gaz. Cukr.*, 1960, **62,** 179–181. Full details are given with a diagram of a horizontal centrifugal slicer which is being tested at Ziebice factory. It contains 24 frames each holding 2 knives; any frames may be removed during operation without stopping the machine, and from 2 to 12 frames may be cut out of operation. The running speed may be varied from 72 to 99·5 r.p.m. through a hydraulic clutch operating at 3 to 30% degree of slip. The theoretical output is shown in a table to be from 620 to 2540 metric tons of beet per day, depending on type of knives, cossette length and thickness, etc.

* * *

Performance of a DdS diffuser during two campaigns. J. MIJAKOWSKI. *Gaz. Cukr.*, 1960, **62,** 212–217.—Performance data are given for the DdS diffuser at Goslawice factory. Campaign averages for 1958/59 and 1959/60 respectively were: 106·5% and 107·1% draught, 0·33% losses in pulp (in both cases), 16·1 and 19·6° raw juice Brix, 88·8 and 91·7 purity, and throughputs of 1425 and 1217 metric tons of beet per day. Other data are given showing the effects of temperature, daily slicing rate, and draught on % sugar in pulp, and of alterations in the scroll speed, as well as the effect of disinfecting with formalin at various doses. Comparison is also made with the results using an Olier diffuser. Basically there is little difference, but the Silin constant[2] for the DdS at 14×10^{-5} is twice that of the Olier at identical losses (0·3–0·4% on beet), and retention time is 80–120 min compared with 60–70 min.

* * *

Treatment of sugar beet wastes by lagooning. D. C. KALDA. *Purdue Univ. Eng. Bull.*, 1959, **43,** (3; *Extension Ser.*, No. 96), 126–139; through *S.I.A.*, 1960, **22,** Abs. 776.—Beet flume, wash and pulp screen waters at Belle Fourche factory, South Dakota, are passed through vibrating screens to three lagoons in series, having a total area of 16·5 acres for a daily flow of about five million gallons, before discharge to an irrigation reservoir formed by a diversion of a river. A theoretical detention time of 24 hours was found in practice to give 95% reduction in suspended solids, and obviated any pollution of the reservoir. Series operation gave no significant improvement. A flow diagram, maps, and tables of improvement in B.O.D., etc., are given. Pulp silo drainage water was retained in separate lagoons for controlled discharge after the campaign.

[1] IZRAELEVICH: *I.S.J.*, 1960, **62,** 104.
[2] *I.S.J.*, 1958, **60,** 144.

New Books and Bulletins

Tongaati—an African Experiment. R. G. T. WATSON. 260 pp; 6 × 9¼ in. (Hutchinson & Co. (Publishers) Ltd., 178–202 Gt. Portland St., London W.1.) 1960. Price: 30s. 0d.

Written by a director of the Tongaat Sugar Company, who has been Chairman of the Tongaat Town Board since its inception in 1930, this book contains a most vivid account of the development of the Sugar Estate, from the days when it was but a settler-farmer enterprise up to the 1954/55 season, when over 100,000 tons of sugar were produced. More than a history of the Sugar Company, however, the book is an account of the development of the Tongaat township, in which the multi-racial community (Europeans, Africans and Indians) enjoys all the advantages of modern living conditions with every amenity in the way of health service and education. It is pointed out that there are still some slums, but, as the illustrations clearly show, conditions are vastly different from those obtaining years ago when squalor and disease prevailed. A depressing note is struck, however, by references to the effects on the community of the policies of the present Government. The book is very well written and makes very interesting reading.

* * *

Translation from Russian for Scientists. C. R. BUXTON and H. SHELDON JACKSON. 299 pp; 5½ × 8¾ in. (Blackie & Son Ltd., 17 Stanhope Street, Glasgow C.4.) 1960. Price: 30s. 0d.

This is by far the best book on the subject so far published. Apart from the grammar section, translation exercises are given and the bulk of the book is devoted to Russian extracts (annotated and non-annotated) on a number of subjects under the two headings physics and electrical engineering, chemistry and chemical engineering. An ample vocabulary is provided at the end with some common abreviations. Altogether an excellent work, it suffers from very few typographical errors, although the print used for the Russian texts is rather small.

* * *

Sugar Year Book 1959. v + 209 pp; 3½ × 5¼ in. (International Sugar Council, 28 Haymarket, London S.W.1.) 1960. Price: 20s. 0d.

This is the 13th Edition of the Year Book and contains statistics for centrifugal sugar production in 88 countries, i.e. two more countries (El Salvador and Honduras) than included in the previous edition. The information has naturally been brought up to date, covering production for the period 1953/59 inclusive, although the general layout remains unchanged. Unfortunately the price has been doubled.

Zuckerwirtschaftliches Taschenbuch 1960. (Economic Sugar Pocket Book.) H. MOSOLFF and G. BRUHNS. 163 pp; 4 × 5¾ in. (Verlag Dr. Albert Bartens, Lückhoffstr. 16, Berlin-Nikolassee, Germany.) Price: DM 8·00.

Apart from containing more up-to-date information, the 7th edition of this handy little book differs very little from the 6th edition[1] in layout. It is a very useful publication, particularly for those who wish to know details of European, and especially German, sugar production.

* * *

Report of the Rothamsted Experiment Station, 1958. 288 pp; 6 × 9½ in. (The Rothamsted Experiment Station, Harpenden, Herts.) 1959. Price: 10s 0d

The Station's Reports have assumed for some years a standard form and, as earlier stated[2], the ground covered is so extensive that any adequate account is impossible. Biochemical research, in growing measure, has drawn attention to the importance of the micro-elements in the chain of enzyme reactions[3]; deficiency of magnesium in the pasture is known to be the cause of "staggers" in sheep, a herbal ley is known to contain more Mg than a grass and clover ley while the Report states (p. 57):

> "In most of the comparisons all crops (except kale) grown with farmyard manure removed more micro-nutrients than did crops with full dressings of NPK fertilisers, because farmyard manure gave higher yields than fertilisers."

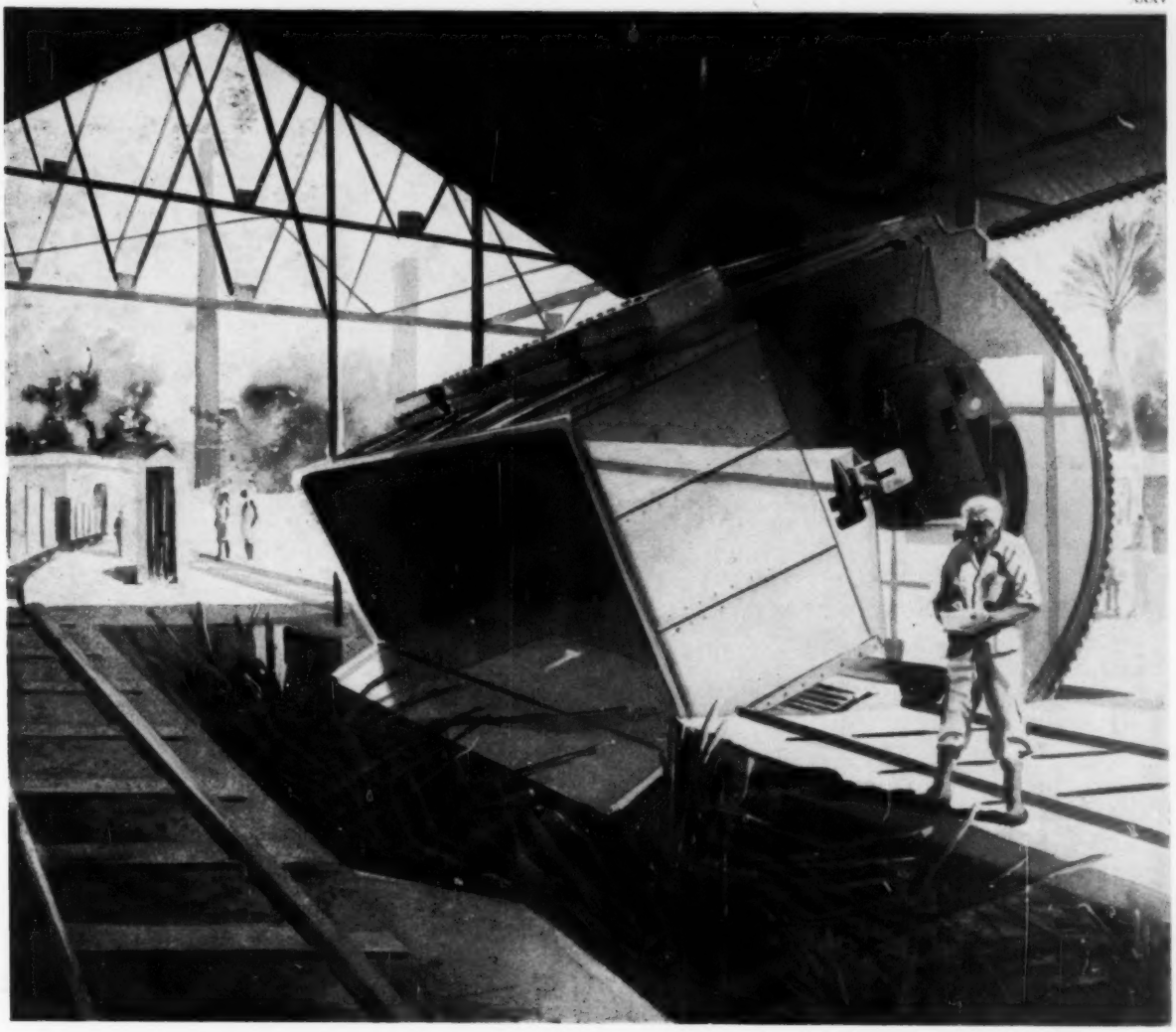
Here is indicated a range of interrelated problems awaiting investigation, among the possibility that the deep-rooted species of the herbal ley draw trace elements from a fund buried in the sub-soil thus adding to the supply, and whether other organic materials may not be equally efficacious.

The emphasis laid on protection from pests and diseases, in place of prophylaxis, too, shows a certain lack of balance, for four sections and a scientific staff numbering 65 with 55 assistants are so concerned compared with a staff of 82 with 67 assistants for all the remaining sections.

The Report contains little of direct interest to the sugar industry though, with growing recognition of the importance of nematodes as a potential serious pest, the report of the Nematological Section (pp. 111–116) will be of interest.

H. M.-L.

[1] *I.S.J.*, 1959, **61**, 343.
[2] *I.S.J.*, 1959, **61**, 343.
[3] *I.S.J.*, 1960, **63**, 59.



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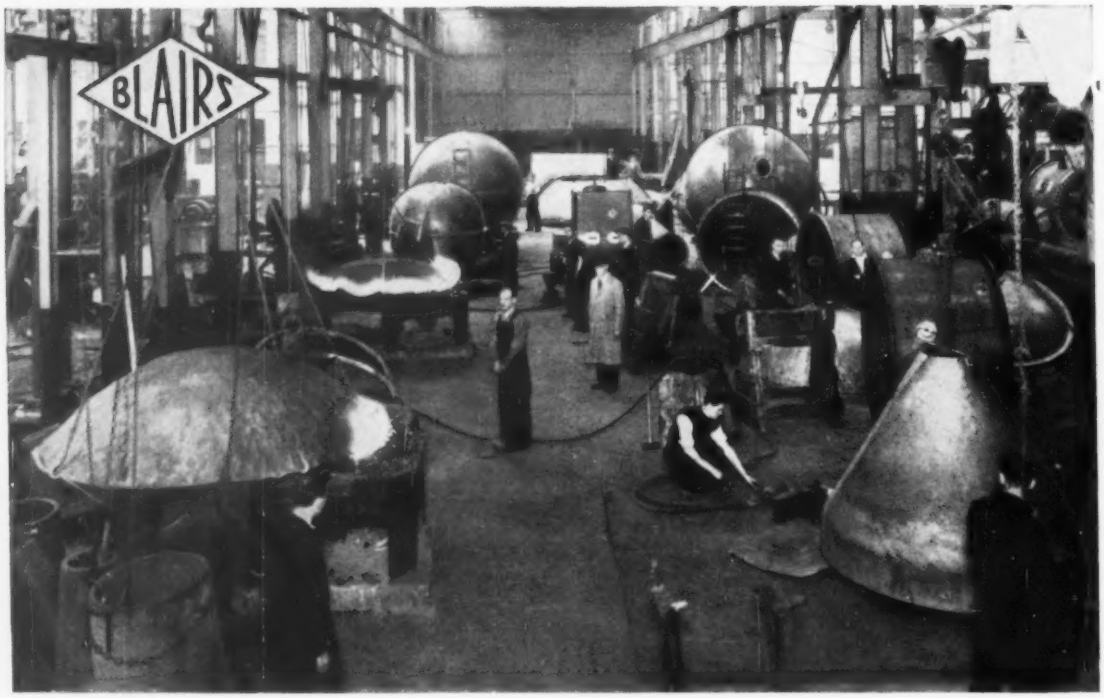

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LABORATORY METHODS AND CHEMICAL REPORTS

A report from Peru—field earth and sucrose balance. F. PROSKOWETZ and J. C. P. CHEN. *Sugar J.* (La.), 1960, **23,** (2), 9–13.—Abnormally high undetermined loss figures have resulted from a considerable amount of soil, adhering to cane gathered mechanically, in the mixed juice in Peruvian factories. To determine the amount of soil in the juice a 500–600 ml sample of juice should be stood for 3 hr in a pre-weighed graduated cylinder, (formalin being added as a preservative) and the precipitate volume determined. From the supernatant density, volume and total weight the precipitate density is calculated, and thus the precipitate weight % total sample. Examination of a considerable number of samples, from which some of the precipitate was withdrawn carefully and analysed for dry earth solids, showed a fairly constant factor of 70% w/v dry earth in the precipitate. This factor can be assumed for determining the weight of earth in juice; alternatively, the precipitate volume % can be used as a routine control determination.

* * *

Studies in gur manufacture[1]. II. A test for strike temperature in gur manufacture. A. J. DANGRE. *Proc. 16th Conv. Deccan Sugar Tech. Assoc.* (India), 1959, 57.—The method for determination of the strike point is based on the fact that a crystal placed in a saturated solution will neither dissolve nor grow. The crystals are placed in the syrup sample under the microscope and if the edges remain fine, the boiling is stopped.

* * *

Fructose in cane juices. K. PARTHASARATHI and M. VIJAYASARADHY. *Proc. Third All India Conf. Sugarcane Res. and Development Workers*, 1957, 203–206; through *S.I.A.*, 1960, **22,** Abs. 644.—The fructose content of mature stalks of different sugar cane and wild cane (*S. spontaneum*) varieties has been determined by a modified van der Plank method. The diluted juice, to which 0·221% of KI is added, is titrated with N/100 thiosulphate solution. From a reference graph the quantity of glucose equivalent to the fructose found is determined. The percentage of total reducing sugars is also determined as glucose. Subtraction gives the actual glucose percentage. From the tabulated results it appears that the ranges of glucose and fructose contents in both types of cane are about the same. The fructose content is always higher than the glucose content; the fructose: glucose ratio varies within a wide range. A more detailed study of fructose and glucose contents at different stages of cane growth is recommended.

* * *

Effect of ^{60}Co gamma-radiation on sucrose solutions. M. A. KHENOKH, E. A. KUZICHEVA and V. F. EVODIKIMOV. *Doklady Akad. Nauk S.S.S.R.*, 1960, **131,** 684–687.—Experiments were carried out to determine the rôle played by radiolysis products of water—the free radicals OH, HO_2 and H_2O_2—in the radiochemical changes of sucrose. The radiation was applied at about 900 curies in doses of $4{\cdot}1–10{\cdot}5 \times 10^{15}$ equ/ml/sec to 0·1 M sucrose solution. Chromatographic analysis of the organic acids was carried out with *n*-butanol:water:acetic acid and *n*-butanol: formic acid:water (19:1:7) as solvents. The solutions were converted to ammonium salts and then concentrated to 1–2 ml at 40°C. Some tests were carried out under vacuum. It was found that the water radiolysis products differ in their chemical action on sucrose. Sucrose hydrolysis with liberation of fructose was caused mainly by the OH radicals. The action of perhydroxyl (HO_2) increased the hydrolysis very slightly. Rupture of the C chains with formation of dihydroxyacetone was also less effective in the presence of O_2, i.e. under those conditions where HO_2 radicals are formed: $H_2O \rightleftharpoons H + OH$; $H + O_2 \rightleftharpoons HO_2$. However, when the C-C bonds in the sucrose were broken with the formation of formaldehyde, no differences were detected between irradiation of sucrose in the presence of oxygen or under vacuum. In this case, it is obvious that the OH and HO_2 radicals have a specific effect on certain chemical compounds in the sucrose molecule. The results also show that H_2O_2 did not cause any noticeable chemical change in the sucrose.

* * *

A study of the thermophysical properties of sugar solutions. A. M. CHERNYI. *Izvest. Vysshikh Ucheb. Zaved.—Pishch. Tekhnol.*, 1960, **16,** (3), 150–157.—A method of determining the heat transfer coefficients of various liquids, including sugar solutions, is described. The apparatus comprises a balanced-type Wheatstone bridge resistance thermometer with a heater composed of electrical conductor wires placed cylindrically. Results of tests conducted on glycerine, castor oil at 20–96°C and on water at 20–70°C are presented in graph form. The theoretical basis of the cylindrical conductance heater is discussed mathematically.

* * *

Determination of average equivalent weight and total weight of plant acids by ion exchange resins applied to sugar beet molasses. J. B. STARK. *J. Agric. Food Chem.*, 1960, **8,** 234–236; through *S.I.A.*, 1960, **22,** Abs. 605.—Two cation exchange columns and one anion exchange column were used for the separation of acids from beet molasses. The method of determining average equivalent weight and weight percent of the acids is described. Corrections are applied for blank values obtained from the acidic resin decomposition products and neutral molasses constituents. Californian beet molasses showed an average equivalent weight of 82·1, with a standard deviation of 0·4.

[1] *See also I.S.J.*, 1959, **61,** 207.

Colorimetric determination of phosphate in sugar products. J. J. CINCOTTA. *J. Agric. Food Chem.*, 1960, **8**, 145–147; through *S.I.A.*, 1960, **22**, Abs. 608. Misson's method[1] has been applied to sugar products. The sugar sample (1 g in 10 ml of water) is digested with 30 ml of conc. HNO_3 and reduced to 5 ml. After cooling, 7 ml of conc. H_2SO_4 are added and the mixture is heated gently until pale yellow to colourless (SO_2 evolved), cooled, diluted, boiled, cooled again and diluted to 100 ml. A yellow colour, proportional to the amount of orthophosphate present, is formed when an excess of ammonium molybdate (containing 5% of MoO_3) and an acidified (1·2 N or 0·25 N–H_2SO_4) solution of ammonium vanadate (2·35 g/500 ml of water) is added to the phosphate solution (50 ml). The colour is measured at 420 mμ and the phosphate concentration is determined by reference to a calibration curve (after allowance is made for any colour in the original sample). A table of results for various raw sugars, refinery syrups, refined sugars and molasses is given.

* * *

Radiation chemistry of carbohydrates. IV. The effect of gamma radiation on aqueous solution of sucrose. G. O. PHILLIPS and G. J. MOODY. *J. Chem. Soc.*, 1960, 762–768; through *S.I.A.*, 1960, **22**, Abs. 616.—Yield-dose curves obtained from the results of isotope dilution and paper chromatographic analyses reveal that glucose and fructose are primary products of γ-irradiation of aqueous sucrose solutions, together with smaller amounts of glucosone and gluconic acid. Secondary products were glucuronic acid, 2-oxogluconic acid, arabinose and two- and three-carbon aldehydic fragments. Formic acid and CO_2 were final products of irradiation; H_2O_2 was continuously formed. The amounts of volatile and non-volatile acids formed, and changes in optical rotation and absorption spectrum were determined. Suggestions concerning degradation mechanisms are given.

* * *

Automatic laboratory device for continuous carbonatation with or without recycling. S. LANGE. *Sucr. Belge*, 1960, **80**, 1–3.—A diagram is presented of a laboratory-scale carbonatation scheme in which the juice flow from the liming tank, via two pipettes and finally to the carbonatation vessel, is controlled automatically by means of valves, electrically- and pneumatically-actuated. The CO_2 feed to the carbonatation vessel is also automatically controlled, as is the vapour flow for heating of the vessel. Two different recycling methods are obtainable, in addition to simple carbonatation without recycling.

* * *

Solubility of magnesium carbonates and oxide in sucrose solutions. P. V. DENISOV and O. I. BELOVA. *Trudy Inst. Khim., Akad. Nauk Kirgiz S.S.R.*, 1955, **6**, 101–108.—The solubility of MgO, $MgCO_3$ and basic carbonate in 5, 10, and 20% sucrose solutions was determined at 20–55°C and at b.p. in the case of MgO, and at 20°C and b.p. for the carbonates. The solubility of the MgO increased with sucrose concentration, particularly at 20–30°C, from 0·0282 meq/100 ml in 5% to 0·601 meq/100 ml in 20% sucrose solution at 20°C, and fell with increase in temperature at constant sucrose concentration. Solubility was lower at the b.p. of the sucrose solution than in water. The increase in solubility with concentration at the lower temperatures is attributed to the formation of sucrates, while the decrease in solubility with temperature increase is caused by considerable hydrolysis of the Mg sucrates. The same tendencies were found with solubility of the carbonates as with the MgO; the solubility of normal carbonate was greater than of the basic carbonate, e.g. 0·976 meq/100 ml, compared with 0·29 meq/100 ml in 20% sucrose solution. The difference increased with sucrose concentration. The pH of the $MgCO_3$ solution was found to drop from 9·91 to 9·76 at 20°C with increase of sucrose concentration from 5 to 20%; this is attributed to a reduction in the hydrolysis of the carbonate with increase of sucrose concentration and to the interaction between the sucrose and the carbonate.

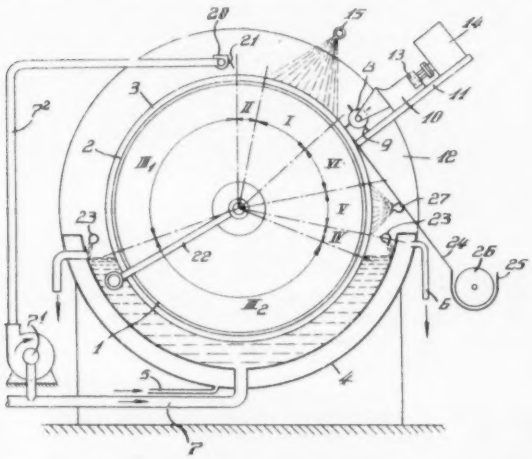
* * *

The removal of interfering ions in the determination of betaine in sugar beet juices and plant material. A. CARRUTHERS, J. F. T. OLDFIELD and H. J. TEAGUE. *Analyst*, 1960, **85**, 272–275.—Ten ml of a beet juice sample containing 1·5–7·5 mg betaine per ml are passed through a mixed bed of "De-Acidite FF" quaternary amino anion exchanger in hydroxide form and "Amberlite IRC-50" cation exchanger in the H form. Choline, dimethylglycine, methylglycine, amino acids and ionic substances are quantitatively adsorbed on the resin mixture, while betaine passes through. The effluent is collected at the rate of approximately 1 ml/min; and the column washed until a total of 50 ml is collected. A 10-ml aliquot is acidified with HCl and ammonium reineckate solution added. The precipitated betaine reineckate is washed free from acid and dissolved in an aqueous acetone solution. The betaine is then determined by Walker & Erlandsen's method[2], in which 10 ml of a solution 0·1 N to both silver nitrate and sodium nitrate is added, the silver reineckate filtered off and washed with 20 ml water, and the combined filtrate and washings titrated with 0·01N NaOH to methyl red endpoint. The betaine content of beet root or leaf was determined by extraction with water (boiling and macerating, or cold extraction in the case of beet root brei), and passing the extract through a resin bed as above. Betaine in molasses analysed by the Walker & Erlandsen method but not passed through the resin bed was of a concentration 9–14% higher than if the resin bed were used, indicating the presence of potentially interfering ions in the molasses.

[1] *Chem. Zeitung*, 1908, **32**, 633.
[2] *Anal. Chem.*, 1951, **23**, 1309.

UNITED KINGDOM

Rotary filter. S.E.R.G. Soc. d'Etudes, Recherches et Gerance and Ecremeuses Melotte. **849,554.** 12th September 1956; 28th September 1960.—A drum 1, provided with a filter cloth 2 and a layer of filter aid 3, rotates in a trough 4 having a double wall to permit the introduction of a heating fluid 5. The liquid to be filtered is admitted through pipe 7, or externally of the main trough 4 by pumping into a trough 20 with an overflow plate 21. The filter aid is applied by an atomizer 15. The liquid in the trough



is agitated by means of 22 and is filtered through to the inside of the drum. The cake is washed by water spray 27 and is removed by the blades 9 of the rotary scraper 8 mounted on carriage 10 and driven by an independent motor. The removed cake slides down ramp 24 to the tank 25 from which it is carried by screw conveyor 26. The rotary scraper carriage 10 may be moved along the rails 11 towards the drum by operation of the gear-motor 14 through screw 13. This technique is used where a thick coating of filter aid is applied initially and gradually reduced as filtration proceeds; alternatively the scraper can be kept in the same position on the carriage and fresh filter aid applied continuously through atomizer 15.

* * *

Beet thinner. National Research Development Corporation, of London W.1. **850,787.** 1st July 1958; 5th October 1960.

* * *

Utilization of molasses spent wash (as animal feed). Joh. A. Benckiser G.m.b.H. Chemische Fabrik, of Ludwigshafen/Rh., Germany. **851,601.** 15th October 1956; 19th October 1960.—Molasses spent wash or distillery waste, or residues from citric acid, methane or glutamic acid production, after sterilization where appropriate, is refined by treatment with schizomycetes, actinomycetes, hyphomycetes or algae (*Streptomyces olivaceous* or *S. aureofaciens*) to form a product suitable as an animal feeding stuff or nutritional factor. Autolysates, plasmolysates, thermolysates, cytolysates or hydrolysates of micro-organisms propagated or employed in the production of the spent wash may be added to promote the refining treatment.

* * *

Beet topper. W. Stoll, of Peine, Niedersachsen, Germany. **851,717.** 21st December 1956; 19th October, 1960.

* * *

Allo-iso-**Citric acid fermentation.** Kyowa Hakko Kogyo K.K., of Tokyo, Japan. **852,486.** 3rd July 1958; 26th October 1960.—See U.S.P. 2,949,404[1].

* * *

Apparatus for contacting solids with liquids (Cane diffusion). National Cylinder Gas Co., of Chicago, Ill., U.S.A. **852,907.** 4th February 1957; 2nd November 1960.—See U.S.P. 2,950,998[2].

* * *

Electrodialysing aqueous (sugar) solutions. Ionics Inc., of Cambridge, Mass., U.S.A. **854,095.** 17th December 1958; 16th November 1960.—See U.S.P. 2,863,813[3].

* * *

UNITED STATES

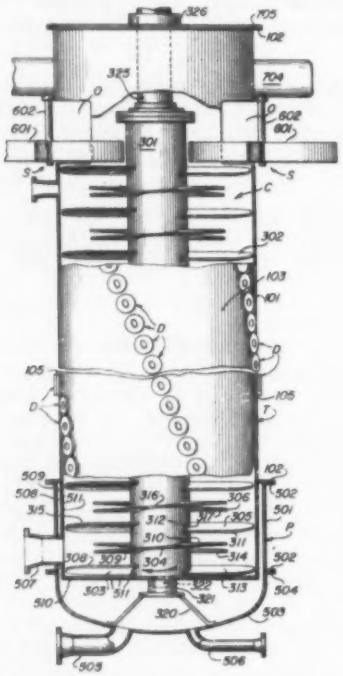
Glutamic acid recovery. (A) E. V. Cardinal, assr. International Minerals & Chemical Corp., of Chicago, Ill., U.S.A. **2,849,468.** 1st February 1954; 28th August 1958. (B) E. V. Cardinal and W. A. Dow, assrs. International Minerals & Chemical Corp., of Chicago, Ill., U.S.A. **2,929,681.** 27th December 1956; 22nd March 1960.—(A) The glutamic acid content of a solution (concentrated Steffen's filtrate) is adjusted by diluting to 0·1–10·% and zinc chloride or freshly precipitated zinc hydroxide added, with or without magnesium hydroxide which forms a double salt. After adjustment to pH 6·3–10·5 (8–9·5) with NaOH or $Ca(OH)_2$ and standing for 1–24 hr, zinc glutamate or magnesium zinc glutamate are precipitated and recovered by filtering. (B) The insoluble zinc glutamate is treated with 50% NaOH solution, using 6 mols of NaOH per mol of glutamic acid, giving a pH of 12·4–13·0 at 80–90°C. After filtration of the precipitated zinc hydroxide the solution remaining contains sodium glutamate.

[1] *I.S.J.*, 1960, **62**, 361.
[2] *I.S.J.*, 1961, **63**, 28.
[3] *I.S.J.*, 1959, **61**, 220.

Glutamic acid recovery. H. L. FIKE, of Chicago, Ill., U.S.A., assr. INTERNATIONAL MINERALS & CHEMICAL CORP. **2,952,705.** 12th June 1958; 13th September 1960.—Betaine hydrochloride and glutamic acid hydrochloride are crystallized from a hydrochloric acid hydrolysate (of pH 0) of a concentrated beet waste liquor [concentrated Steffen's or barium filtrate or a fermentation residue of 60–85% (65%) solids]. The solids, amounting to 40–47·5% (45%) of the hydrolysate are separated and the liquor reacted with an alkaline hydrolysate of a beet waste liquor to give a mixture of pH 4–6 (4·5–5·5). This is concentrated to 60–85% (80%) solids and desalted (by crystallization and separation of the crystals) at pH 4–6, and combined with the crystallized hydrochlorides above to give a solution of pH about 3·2 from which glutamic acid crystallizes.

* * *

Apparatus for contacting solids with liquids. (Cane diffuser). R. M. STEWART and W. P. SEVIN, assrs. CHEMETRON CORPORATION. **2,950,998.** 1st March 1956; 30th August 1960.—The cane diffuser consists of a steel tower *T* formed from hollow cylindrical



sections 101 ending in flanges which are held together by bolts or welding. The bottom of the tower fits into a pan section *P* which contains a spider 320. The top plate of the tower holds a thrust bearing 326. Between this bearing and the spider extends a hollow shaft 301 with reduced ends 322, 325, driven by an external top-mounted motor and gearing. The shaft carries a single or multiple interrupted helical screw conveyor *C* in the form of segments 303, 313, 309, 314, etc. the size of which depends on the number of helices included in the conveyor, e.g. 90° segments for the double-helix illustrated or 180° for a single helix. The pitch of these segments is chosen in accordance with the size of the plant but generally provides for a rise of 3–6 inches at the outer edge near the tower wall 103. Between the segments are stationary interruptor or deflector elements *D* in the form of solid or hollow bars of elliptical section held by flanges 105, extending radially inwards in sets of four and ending close to the shaft 301. The pitch of the deflectors *D* is generally about 45° opposite to that of the segments, so providing turbulence and lift towards the top of the tower. The deflector mountings are arranged in a helical path up the tower wall. The side wall 508 and base plate 510 of the bottom cylinder are perforated, the latter being cleaned by the rotation of segments 303, 313, and screen the juice which passes into the space 509 and the bottom of the pan section. Two withdrawal pipes 505, 506 are provided, the first leading to process and the second to a tank where fresh cane chips are mixed with juice before pumping into the tower through pipe 507. Exhausted chips from the top of the tower are removed through ports *O* by means of curved sweep arms 601 mounted on shafts 602 and individually driven by motors 704.

* * *

Centrifugals. E. V. JUNG, S. H. MONTÉUS and N. V. ANDERSSON, assrs. A.B. LANDSVERK, of Landskrona, Sweden. **2,953,250.** 14th November 1956; 20th September 1960.—See U.K. Patent 792,217[1].

* * *

Purification of sugar solutions. W. M. GROSVENOR, assr. THE AMERICAN SUGAR REFINING CO. of New York, N.Y., U.S.A. **2,954,305.** 22nd June 1959; 27th September 1960.—Hot de-gassed raw cane sugar solution is passed upwardly through an elongated vertical column in countercurrent to a downwardly flowing bed of bone char, continuously applying the sugar solution of constant viscosity to the bottom of the column, uniformly distributing it over the whole area, and causing it to flow upwards as a substantially lineal ascending column of sugar liquor through the bed of bone char at such a rate as to maintain this bed in an expanded state. A body of purified solution, from which a continuous draw-off is made, is maintained above the bed, bone char being substantially uniformly distributed at the top of the bed and withdrawn as a slurry from the bottom. The sugar solution is kept at above pH 7·0 and the length of the countercurrent flow is long enough to effect purification. The bone char slurry withdrawn from the column is treated to remove most of the sugar solution and then sweetened-off by passing downwards through a similar column against an upward flow of water which is drawn off as a strong sweet water; the washed char is withdrawn and may be regenerated.

[1] *I.S.J.*, 1958, **60**, 179.

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TWIN SCREW PRESS

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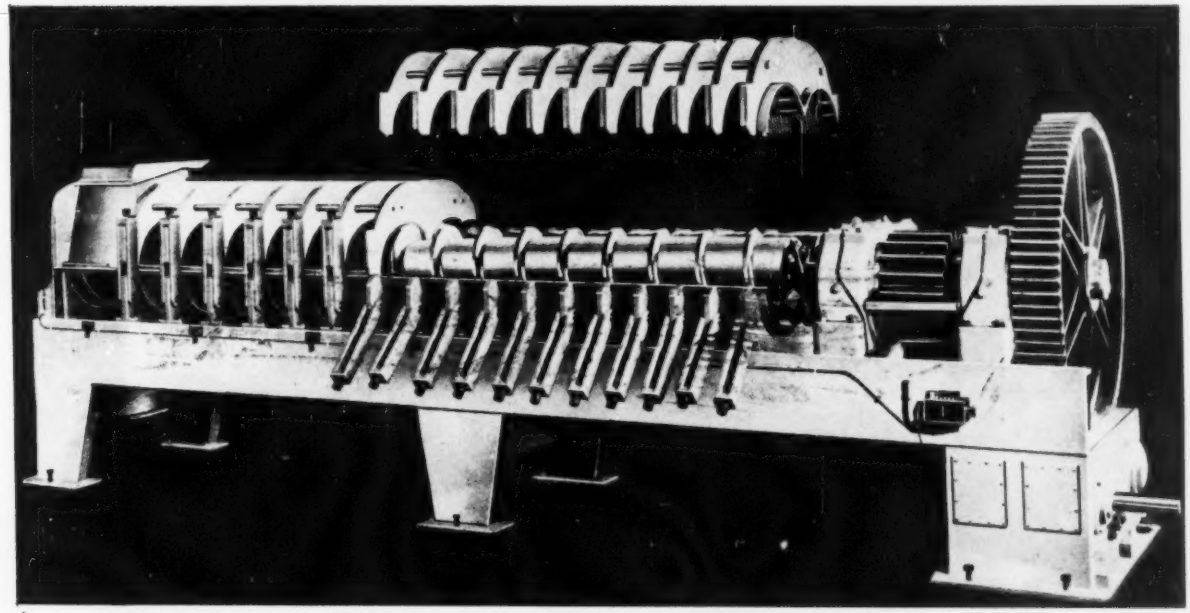
6 sizes, capacities ranging to 1000 tons feed per 24 hours.

The distinguishing characteristics of the Stord Twin Screw Press are:

a. A special Screw System and Design.

b. A superior Straining Effect.

c. Simple and robust Mechanical Design, assuring easy accessibility to all vital areas and parts.



BS-64 Pulp Press — Capacity approx. 1000 tons per 24 hrs — partly opened up for inspection.

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TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Pipe line mixer. Sugar Manufacturers' Supply Co. Ltd., 7/8 Idol Lane, London E.C.3.

A report is now available from the makers describing tests carried out by an independent body—Sondes Place Research Institute, of Dorking, Surrey—on their mixing unit described previously[1]. Three types of mixing were investigated: between immiscible liquids, dilution of final molasses, and carbonatation of limed final molasses.

In the first of these, metered supplies of paraffin and water were passed through two miniature experimental units constructed of polyethylene and glass and measuring approximately 12 in × 1 in diameter. Through these the liquids were passed at a combined rate of 9–13 litres/min (2–3 gal/min) using various paraffin:water ratios. The time of separation of the emulsions was measured and compared with corresponding times for separation of emulsions prepared by vigorous shaking for 15 sec. (This compares with contact times of 0·82–0·57 sec in the mixer.) For dilute emulsions (3:1 and 4:1 water:paraffin), separation took 80–180 sec compared with 7–10 min obtained by shaking; with emulsions of about 1:1 water:paraffin separation required 90–180 sec compared with 30–35 sec for an emulsion obtained by shaking. Back-pressure at these throughputs varied between 3·6 and 8·3 p.s.i.

In the second series of experiments, molasses of 70–80° Brix at 60°C was diluted to 55–60° Brix with water also at 60°C. Combined flow rate was 11·80 kg/min (slightly over 2 gal/min) and the time of contact was about 0·6 sec. The effluent molasses showed no sign of heterogeneity apart from the settling of a solid impurity present in the concentrated molasses.

In the third series, molasses, diluted to 16° Brix and limed to pH 9·4, was passed through the mixer at the rate of 2 gal/min and carbon dioxide pumped in at a pressure of 7·0–9·5 p.s.i. (at 14°C) and 6–10 p.s.i. (for experiments at 50°C). From the data obtained, Sugar Manufacturers' Supply Co. Ltd. calculate that for the reduction of pH to 6·9–7·0 an absorption efficiency of 39–42% is achieved in the very short contact time which is of the order of 0·4 sec.

* * *

Screw conveyor drives. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

Link-Belt Company's new standard double reduction shaft-mounted speed reducer drive for direct application to screw conveyors is the subject of a new 4-page Folder 2718. The speed reducer is available in six sizes with ratios of 15:1, 20:1 and 24:1 for motors up to 30 h.p. It is equipped with a removable steel shaft and a cast iron adapter which contains the shaft seals, for mounting on the conveyor trough end. It is splash lubricated with a built-in baffle system to protect against oil reaching the material in the conveyor and vice-versa.

* * *

"Ultivee" rope drives. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorkshire.

A new folder, Publication 6026, describes the Crofts "Ultivee" rope drives which transmit more power in less space, reducing the number of ropes by as much as 40%, permit smaller pulley diameters and face widths with reduced centre distances, and materially reduce installation and replacement costs. A standardised range of pulleys is available and only three sections of ropes in a large range of lengths cover the majority of industrial requirements.

* * *

PUBLICATIONS RECEIVED

CO_2 RECOVERY AND CONTROL. Cambridge Instrument Co. Ltd., 13 Grosvenor Place, London S.W.1.

List 333 describes the use of Cambridge gas analysis apparatus for control of the purity of CO_2 recovered from fermentation vats in a Belgian brewery for use in bottling. Twelve indicating and controlling points are combined by panel mounting together with a single-point master panel for a final check on CO_2 purity before it passes to the storage tanks.

* * *

AUTOMATIC WEIGHT CONTROL. Elcontrol Ltd., Wilbury Way, Hitchin, Herts.

A new range of electronic weighing equipment, designed for the control of plants handling all types of liquids and solids in bulk, is described in Data Sheet AW Issue 4. The sensing elements are load cells suited for loads varying from 20 lb to 2000 tons, and various types of application are illustrated.

* * *

THE "TORBAL" LABORATORY BALANCE. Baird & Tatlock Ltd., Freshwater Rd., Chawdell Heath, Essex.

By means of an adjustable poise weight the centre of gravity of the "Torbal" balances is accurately positioned above the centre of rotation and inequality of weight between the pans causes the beam to tip in the heavier direction, opposed by the torsional resistance of the bands. No parts move over others so there is no friction and no wear; there is no knife edge fulcrum, and adjustments are permanent. There are three dial-form balances of capacity from 120 g to 4500 g and sensitivities of 3 mg to 0·1 g; and four beam-form balances of 2000–4500 g capacity and of various sensitivities.

* * *

THE PHILIPPE/O.M.S. SUGAR FILTER TYPE D.N.R.S. Filtres Philippe S.A., 109 Boulevard Henri-Barbusse, Houilles (S. & O.), France.

The D.N.R.S. pressure filter, described in a recent publication, was first installed in Italy five years ago and is now available in two sizes. It comprises a series of shaft-mounted discs each consisting of eight independent perforated brass segments fitted with nylon cloth bags, and discharging to pipes leading out through the hollow shaft. The throughput is approximately double that of a filterpress of the same surface, while sugar loss is reduced as are labour requirement and heat loss, and filter cloth life is lengthened.

[1] *See I.S.J.*, 1958, **60**, 213.

FREE MARKET REQUIREMENTS FOR 1961

INTERNATIONAL SUGAR COUNCIL ESTIMATES

The following estimate was adopted by the International Sugar Council on 28th November 1960, at its Eighth Session, as referred to on page 1 of this issue.

COUNTRY OR AREA—		*Total Requirements (in thousands of metric tons, raw value)*
UNITED KINGDOM and BRITISH COMMONWEALTH—		
(*a*) **United Kingdom and Dependent Territories—**		
United Kingdom	1950	
Aden and Aden Protectorate	20	
Bahamas and Bermuda	5	
British East Africa—Kenya, Uganda, Tanganyika, Zanzibar and Pemba	45	
British North Borneo	10	
Gibraltar and Malta	15	
Gambia and Sierra Leone	15	
Hong Kong	40	
Sarawak and Brunei	15	
State of Singapore	65	
		2180
(*b*) **Independent Members of Commonwealth—**		
Canada		700
Ceylon		175
Cyprus		15
Ghana		50
Federation of Malaya		180
New Zealand and Island Territories		130
Pakistan		0
Federation of Nigeria		75
Federation of Rhodesia and Nyasaland		60
TOTAL (*a*) and (*b*)		3565
Estimated Supplies Available from Exporting British Dependent Territories, Australia and Union of South Africa		2700
Estimated Net Requirements		865
FRANCE, FRENCH OVERSEAS DEPARTMENTS and TERRITORIES—	*Net requirements (thousand tons, refined value)*	
(*a*) France—Metropolitan France and Overseas Departments	—813	
(*b*) French Overseas Territories	+ 5	
(*c*) The Community and Countries which were represented by France at the time of signing the Agreement	+ 75	
	—733	
Balance of Net Import Requirements from Free Market		0
EUROPE (Excluding United Kingdom and France)—		
Belgo/Luxembourg Economic Union	0	
Finland	130	
Germany (West)	15	
Greece	110	
Iceland	10	
Ireland	40	
Italy	10	
Norway	150	
Spain (excluding Canary Islands, Ceuta and Melilla)	25	
Sweden	40	
Switzerland	210	
U.S.S.R.	815	
Yugoslavia	50	
		1605
AMERICA—		
Bolivia	25	
Chile	190	
Honduras	10	
Uruguay	100	
		325
Carried forward		2795

ESTIMATE OF FREE MARKET REQUIREMENTS FOR THE CALENDAR YEAR 1961—*continued*

	Net requirements (in thousands of metric tons, raw value)	
Brought forward		2795
COUNTRY OR AREA		
AFRICA (Other than British Commonwealth countries and French Overseas Departments and Territories)—		
Canary Islands, Ceuta and Melilla	10	
Liberia	5	
Libya	25	
Morocco	400	
Somalia	10	
Sudan	140	
Tunisia	75	
U.A.R. (Southern Region)	140	
		835
ASIA (other than British Commonwealth Countries)—		
Afghanistan	30	
Burma	20	
Cambodia	15	
China (Mainland)	510	
Iran	250	
Iraq	205	
Israel	40	
Japan	1180	
Jordan	50	
Korea (South)	85	
Laos	5	
Lebanon	35	
Mongolia	5	
Saudi Arabia and neighbouring Red Sea and Persian Gulf Territories	110	
U.A.R. (Syrian Region)	60	
Viet-Nam	50	
OCEANIA (excluding New Zealand, Western Samoa and French Overseas Territories)—		
Polynesia and Micronesia	5	
		2655
		6255
Allowance (2%) for possible under-estimates, supplies for ships stores, and the unexplained disappearance of sugar		125
		6380

BREVITIES

India cane acreage.[1]—The first estimate of the area devoted to cane in India in the season which is about to commence is 5,157,000 acres. This compares with the first estimate for 1959/60 of 4,975,000 acres which has since been revised to the all-time record of 5,178,000 acres. Initial estimates of the area in India are invariably on the conservative side and there would seem to be every every prospect that this figure will easily be surpassed this season.

* * *

New factories in India[2].—Two applications for the establishment of sugar factories in Andhra Pradesh have been approved by the Central Government of India while three other applications are under consideration. Three factories are to be set up in Saurashtra—at Dhrol in Jamnagar district, Dhola in Bhavnagar district, and Chana Vaden in Junagadh district. Two factories will be built in Orissa; the Aska Sugar Mill is expected to go into production in November 1961 and the other in 1963/64.

* * *

New Italian beet factories[3].—A second beet sugar factory is to go into operation soon at Villafor near Cagliari in Sardinia. The factory will process 1200 tons of beet per day and will permit expansion of the beet area of the island. The new factory of Soc. Italiana per l'Industria degli Zuccheri at Rendina, near Melfi, has officially been put into operation, and its capacity shown to exceed that originally planned, viz. 350 tons of sugar per day. The Company has already erected and modernized other sugar factories in Southern Italy, e.g. at Latina, Chieti and Battipaglia, while a further factory is to be erected in the Province of Foggia.

Molasses utilization in India[4].—Six chemical factories with molasses as the main raw material are expected to be set up in Uttar Pradesh. They will produce antibiotics, nylon, synthetic rubber, butyl alcohol, citric acid and yeast, according to Dr. SITARAM, the U. P. Minister for Transport and Excise.

* * *

South African sugar crop, 1960[5].—As a result of an adjustment in growers' cane delivery quotas in the current season the original cut of 25% has been changed to 23% and this is expected to have the effect of increasing sugar production to about 866,960 tons from factories in Natal and Zululand. The two Swaziland mills should produce 68,890 tons, giving a combined production of about 935,850 tons. Several mills will have closed down at the end of November, the majority during December and the last will have closed down by the middle of January. Although some rain fell in the last ten days of September relieving the serious drought from which the sugar belt had been suffering, the total rainfall in the first nine months of 1960 was more than 2½ in below normal. By the end of September 210,621 tons had been exported, 132,905 tons going to the United Kingdom. Among other countries to which shipments were made in 1960 are Canada, Rhodesia and Nyasaland, East Africa and Malaya.

[1] C. Czarnikow Ltd., *Sugar Review*, 1960, (479), 179.
[2] *Indian Sugar*, 1960, **10**, 323.
[3] *Zeitsch. Zuckerind.*, 1960, **85**, 551; F. O. LICHT, *International Sugar Report*, 1960, **92**, (11), 105–6.
[4] *Indian Sugar*, 1960, **10**, 384–385.
[5] *Commonwealth Producer*, 1960, (380), 217.

BREVITIES

New factories for Indonesia[1].—A new sugar factory is to be built on the Indonesian island of Lombok, as part of a plan providing for extension of the sugar industry. A second factory is to be erected at Atjeh in Northern Sumatra.

* * *

Ste. Madeleine Sugar Co. Ltd. 1959/60 Report.—A record crop of over 73,000 tons of sugar was produced in spite of the cane having a poorer sucrose content than in the previous year, though a better tonnage per acre. The entire output has been disposed of as a result of Commonwealth sugar quota reallocations and a small allocation for shipment to the U.S.A. Replacement of the east mill in the factory has been postponed.

* * *

Mexican sugar strike[2].—Some 45,000 members of the Sugar Industry Workers' Union went on strike on the 16th November, paralyzing production in sugar processing plants throughout the country. Another 85,000 workers, members of the Sugar Cane Growers' Union, joined the strike, supporting the demands of the sugar workers who are asking for a 40% wage increase and other benefits.

* * *

India and the International Sugar Agreement[3].—India wishes to become a member of the International Sugar Agreement, according to Mr. S. K. PATIL, the Minister of Food, who explained that this was necessary to enable India to establish an export market and export sugar to the United States where the prices of sugar were comparatively higher than the world prices. It has been reported[4], however, that India requires a substantial quota, the figure of 500,000 tons being mentioned.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 16th December*, 1960)	
Anglo-Ceylon (5s)	13/4½
Antigua Sugar Factory (£1)	13/3
Booker Bros. (10s)	27/–
British Sugar Corp. Ltd. (£1)	24/–
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	16/3
Distillers Co. Ltd. (10s units)	39/10½
Gledhow Chaka's Kraal (£1)	43/9
Hulett & Sons (£1)	60/–
Jamaica Sugar Estates Ltd. (5s units)	4/6
Leach's Argentine (10s units)	20/–
Manbré & Garton Ltd. (10s)	58/3
Reynolds Bros. (£1)	43/9
St. Kitts (London) Ltd. (£1)	19/–
Ste. Madeleine (Ord.) (£1)	27/–
Sena Sugar Estates Ltd. (10s)	13/7½
Tate & Lyle Ltd. (£1)	47/3
Tate & Lyle Investments Ltd. (5s)	10/6
Trinidad Sugar (5s stock units)	41/–
United Molasses (10s stock units)	37/6
West Indies Sugar Co. Ltd. (£1)	19/–

CLOSING MIDDLE

New York Stocks (*at 15th December*, 1960)	$
American Crystal ($10)	39¼
Amer. Sugar Ref. Co. ($100)	28⅝
Central Aguirre ($5)	22
Cuban American ($10)	14⅝
Great Western Sugar Co.	28¾
South P.R. Sugar Co.	14¾
United Fruit Co.	16

Caroni Ltd. 1959/60 report.—In contrast to 1959, when there was a severe drought in Trinidad, the 1960 crop was grown and reaped in almost ideal weather conditions. The yield of sugar per acre was 17% higher than the previous year; the cane was almost free from damage by insect pests, the factory ground almost a million tons of cane in a crop period of 156 days and production at 95,510 tons was 17,253 tons more than the previous best, and almost 20,000 tons better than the 1959 crop. Further examination of the scheme for making paper from bagasse which has been under review for the past two years has been deferred indefinitely. Bagasse surplus to fuel requirements continues to be supplied to Celotex Ltd. for the manufacture of boards in England, and the Company is actively pursuing other possibilities of using bagasse more profitably than as fuel, a prospect which is brought closer now that natural gas is readily available as a fuel substitute.

* * *

The late Dr. W. D. Horne.—We regret to announce the death on the 5th December of Dr. WILLIAM D. HORNE, the originator of the "dry lead" method of clarifying sugar solutions prior to polarization. He was born in 1865 and received his early training at Columbia University, following which he was appointed chemist at Oxnard refinery, Brooklyn, in 1886. In 1894 he was awarded the Ph.D. of Columbia on a thesis entitled "Recent improvements in sugar refining and sugar machinery". In 1895 he became chief chemist to the National Sugar Refining Co. of Yonkers, N.Y., and in 1904 went to Cuba as consultant to the Cuban-American Sugars Co. His association with National and Cuban-American lasted until 1920 when he joined the staff of the Hershey Sugar Co. in Cuba. While with this concern, led by his familiarity with both raw sugar production and refining, he sought to bring about the closer co-operation of the two branches of the industry and so modified the production side of the process as to obtain a sugar polarizing at about 99·1 which could be stored for long periods and refined very economically[5].

It was about 1903 that Dr. HORNE developed the use of anhydrous lead subacetate for the clarification of sugar solutions for their polarimetric analysis which method was put forward as a means of avoiding the volume of precipitate error at that time under eager discussion[6]. PELLET criticized the method on the ground that it resulted in a decrease in polarization owing to the retention of sucrose in the precipitate[7]. In a notable controversy carried on by HORNE and other chemists in this *Journal*, it was shown that if dry lead were added in minimal amounts there was no appreciable retention of sucrose in this way[8].

HORNE's reputation by no means rested solely on his work on the dry lead method since in his later career he displayed much ingenuity and resource in both laboratory and sugarhouse, as will be apparent from examination of our indexes of the period, when he investigated, among other things, ash and colour adsorption by carbons[9], determination of unreduced copper by a volumetric cyanide process[10], an affination test for raw sugars[11], clarification in the sugar factory[12], decarbonization of bone char in a rotary kiln[13], etc. HORNE retired in 1930 to his country home among the mountains of Central Pennsylvania, and spent the last four winters at Merwick House nursing home where he died. His name will live long after him in the literature of the sugar industry.

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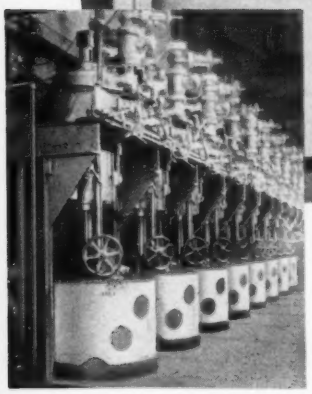
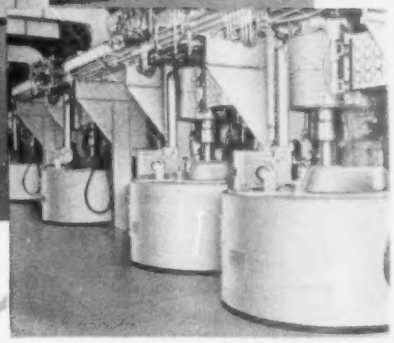
[1] F. O. Licht, *International Sugar Report*, 1960, **92**, (11), 109.
[2] *Public Ledger*, 19th November 1960.
[3] *Public Ledger*, 10th December 1960.
[4] F. O. Licht, *International Sugar Report*, 1960, **92**, (Supp. 22), 277.
[5] *I.S.J.*, 1928, **30**, 435–438.
[6] *J. Amer. Chem. Soc.*, 1904, **26**, 186–192.
[7] *Bull. Assoc. Chim. France*, 1905/6, **23**, 285.
[8] *I.S.J.*, 1907, **9**, 219 (ending the discussion).
[9] *I.S.J.*, 1922, **24**, 298.
[10] *I.S.J.*, 1928, **30**, 501.
[11] *Ind. Eng. Chem.*, 1918, **10**, 809.
[12] *I.S.J.*, 1924, **26**, 443; U.S. Patent 1,486,091.
[13] U.S. Patent 1,121,429.

machines wash A & B sugars to high purity for subsequent refining. These are completely automatic and each battery is sequenced independently.

2945



The 1955 installation . . . manually controlled except for automatic braking.



The 1958 installation . . . incorporates automatic discharging as well as automatic braking.

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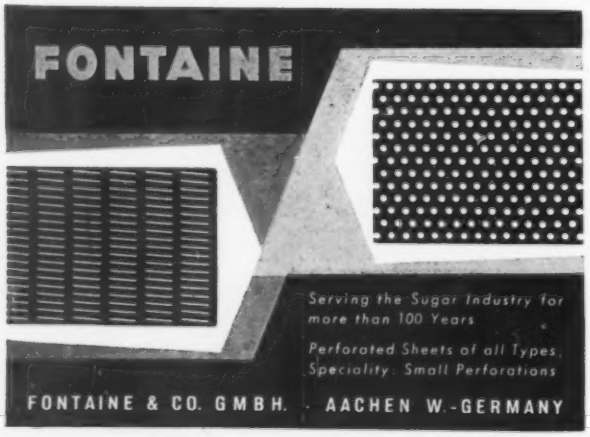
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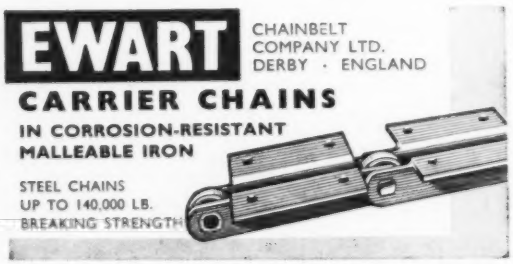

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Certain of the classifications have sub-headings for individual types of equipment. Specialist makers appear under these sub-headings, while inclusion of manufacturers under the general headings implies that they supply all or most of the types of equipment described by the sub-headings.

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Edwards Engineering Corp.
Soc. Fives Lille-Cail.
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see Steam Accumulators.

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Lepage, Urbain & Cie.
S. P. E. I. Chim.
Stork-Werkspoor N.V. (V.M.F.)
Technoexport Czechoslovakia.

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Cape Insulation and Asbestos Products Ltd.
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Bagasse depithing equipment.
Lyddon & Co. Ltd.

Bagasse furnaces.
Babcock & Wilcox Ltd.
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Cellulose Development Corp. Ltd.
Krauss-Maffei-Imperial G.m.b.H. & Co.
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A. F. Craig & Co. Ltd.
A/S De danske Sukkerfabrikker.
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Etablissements A. Olier.
Salzgitter Maschinen A.G.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)

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Catchpole Engineering Co. Ltd.

Beet hoes.
Catchpole Engineering Co. Ltd.
Martin-Markham Ltd.
S.K.H. & Son (Salopian-Kenneth Hudson & Son).

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Cocksedge & Co. Ltd.
AB. Landsverk.
Duncan Stewart & Co. Ltd.
Stord Marin Industri A/S.

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A/S De danske Sukkerfabrikker.

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Cocksedge & Co. Ltd.
Köllmann & Gruhn
H. Putsch & Comp.

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Köllmann & Gruhn
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Beet tare house equipment.
Cocksedge & Co. Ltd.

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Choquenet L. Fonderies et Ateliers.
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The Permutit Co. Ltd.
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see Conveyors *and* Elevators.

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Link-Belt Company.
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Cane carts.
Cary Iron Works.
Firestone International Company
Kingston Industrial Works Ltd.
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Spoorijzer N.V. Delft.

Cane cultivation equipment.
Broussard Machine Co.

Cane harvesters.
Cary Iron Works.

Cane loaders.
Broussard Machine Co.
Cary Iron Works
Walkers Ltd.

Cane slings.
Parsons Chain Co. Ltd.

Cane transport or bulk sugar barges
Walkers Ltd.

Carbon, Decolorizing.
The Clydesdale Chemical Co. Ltd.
Farnell Carbons Ltd.
Haller & Phillips Ltd.
Lurgi Gesellschaft für Chemotechnik m.b.H.
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The Sugar Manufacturers' Supply Co. Ltd.
United Norit Sales Corporation Ltd.

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Dorr-Oliver Inc., Cane Sugar Divn.
George Fletcher & Co. Ltd.
Ets. Neyrpic.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
Stork-Werkspoor N.V. (V.M.F.)

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Officine Meccaniche e Fonderie A. Bosco S.p.A.
Thomas Broadbent & Sons Ltd.
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Duncan Stewart & Co. Ltd.
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Watson, Laidlaw & Co. Ltd.
The Western States Machine Co.

Centrifugal backings.
Ferguson Perforating & Wire Co.
Ets Krieg et Zivy.

Centrifugals—Continuous.
BMA Braunschweigische Maschinenbauanstalt.
Escher Wyss Ltd.
Hein, Lehmann & Co. A.G.

Centrifugals—Fully-automatic batch-type.
BMA Braunschweigische Maschinenbauanstalt.
Escher Wyss Ltd.
Pott, Cassels & Williamson Ltd.
The Western States Machine Co.

Centrifugal motors.
Hinz Elektromaschinen und Apparatebau.
The Western States Machine Co.

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Dorr-Oliver Inc., Cane Sugar Divn.
Ferguson Perforating & Wire Co.
Fontaine & Co.
Hein, Lehmann & Co. A.G.
Ets Krieg et Zivy.
Multi-Metal Wire Cloth Co. Inc.
The Sugar Manufacturers' Supply Co. Ltd.
Tiss-Metal

Centrifugals—Semi-automatic batch-type
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Pott, Cassels & Williamson Ltd.

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Ewart Chainbelt Co. Ltd.
George Fletcher & Co. Ltd.
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Link-Belt Company.
The Mirrlees Watson Co. Ltd.
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Renold Chains Ltd.
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Walkers Ltd.

Char revivifying plants.
Honolulu Iron Works Co.
Stordy Engineering Ltd.

Chemicals.
Associated Chemical Companies (Sales) Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Basic Lead Acetate for Sugar Analysis (ICUMSA specification).
The General Chemical & Pharmaceutical Co. Ltd.

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F. W. Berk & Co. Ltd.

Sulphuric acid.
F. W. Berk & Co. Ltd.
The General Chemical & Pharmaceutical Co. Ltd.

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Westfalia Separator A.G.

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Parsons Chain Co. Ltd.
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George Cohen, Sons & Co. Ltd.
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New Conveyor Co. Ltd.
Unifloc Ltd.

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Unifloc Ltd.

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Unifloc Ltd.

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Choquene L. Fonderies et Ateliers.
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Fr. Hesser Maschinenfabrik A.G.
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SAPAL.
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IMACTI-Amsterdam.
The Permutit Co. Ltd.
Machinefabriek Reineveld N.V.
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IMACTI-Amsterdam.
The Permutit Co. Ltd.
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Duper Water Conditioning Cy.
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The Permutit Co. Ltd.
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Duper Water Conditioning Cy.
IMACTI-Amsterdam.
Paterson Engineering Co. Ltd.
The Permutit Co. Ltd.
Machinefabriek Reineveld N.V.

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Distillery plant, *see* Alcohol plant.

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David Brown Industries Ltd., Radicon Divn.
Crofts (Engineers) Ltd.
Heenan & Froude Ltd.
Salzgitter Maschinen A.G.

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Hinz Elektromaschinen und Apparatebau.

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Evershed & Vignoles Ltd.

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Heemaf N.V.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)

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Evershed & Vignoles Ltd.

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George Cohen, Sons & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)

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Duncan Stewart & Co. Ltd.
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Walkers Ltd.

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Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.

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A. F. Craig & Co. Ltd.
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Kingston Industrial Works Ltd.
Korting Brothers (1917) Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
S.P.E.I. Chim.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.).
Technoexport Czechoslovakia
Walkers Ltd.
Worthington-Simpson Ltd.

Filters.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Cotton Bros. (Longton) Ltd.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
International Combustion (Export) Ltd.
Krauss-Maffei-Imperial G.m.b.H. & Co.
The Mirrlees Watson Co. Ltd.
H. Putsch & Comp.
Duncan Stewart & Co. Ltd.
Werkspoor N.V.
Otto H. York Co. Inc.

Bag pressure filters.
A. F. Craig & Co. Ltd.
Choquenet L. Fonderies et Ateliers

Diatomite filters.
Filtres Philippe S.A.
Niagara Filters Europe.
Etablissements A. Olier.
Paterson Engineering Co. Ltd.
Schumacher'sche Fabrik.
Sparkler International Ltd.
Unifloc Ltd.

Filter presses.
Filtres Philippe S.A.
Choquenet L. Fonderies et Ateliers.
S. H. Johnson & Co. Ltd.
Progress Engineers Ltd.
Salzgitter Maschinen A.G.
Unifloc Ltd.

Gravity & pressure filters.
The Permutit Co. Ltd.

Iron removal filters.
Electromagnets Ltd.
The Permutit Co. Ltd.
Rapid Magnetic Ltd.
Unifloc Ltd.

Leaf filters.
Dorr-Oliver Inc., Cane Sugar Divn.
Ferguson Perforating & Wire Co.
L. A. Mitchell Ltd.
Niagara Filters Europe.
A. & W. Smith & Co. Ltd.
Sparkler International Ltd.
Suchar Sales Corporation.

Plate and frame filters.
Blairs Ltd.
Choquenet L. Fonderies et Ateliers.
S. H. Johnson & Co. Ltd.

Pressure filters.
Dorr-Oliver Inc., Cane Sugar Divn.
Eimco (Gt. Britain) Ltd.
Filtres Philippe S.A.
Niagara Filters Europe.
The Permutit Co. Ltd.
Progress Engineers Ltd.
Sparkler International Ltd.
Suchar Sales Corporation.

Rotary vacuum filters.
Dorr-Oliver Inc., Cane Sugar Divn.
Eimco (Gt. Britain) Ltd.
Etablissements A. Olier.
Filtres Philippe S.A.
Unifloc Ltd.

Upflow filters.
IMACTI Amsterdam.

Filter-aids.
F. W. Berk & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Dicalite Dept., Great Lakes Carbon Corp.
Farnell Carbons Ltd.
T. B. Ford Limited.
Haller & Phillips Ltd.
Johns-Manville International Corp.
Scottish Diatomite Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Chas. H. Windschuegl Ltd.

Filtercloths.
Cotton Bros. (Longton) Ltd.
Heath Filtration Ltd.
G. H. Heath & Son (1952) Ltd.
Samuel Hill Ltd.
S. H. Johnson & Co. Ltd.
Multi-Metal Wire Cloth Co. Inc.
Nordiska Maskinfilt AB.
Tiss-Metal.

Filter-leaves.
Dorr-Oliver Inc., Cane Sugar Divn. (*Sweetland*).
Ferguson Perforating & Wire Co.
Multi-Metal Wire Cloth Co. Inc.
Niagara Filters Europe.
Progress Engineers Ltd.
A. & W. Smith & Co. Ltd.
Sparkler International Ltd.

Filter papers.
W. & R. Balston Ltd.
T. B. Ford Limited.
The General Chemical & Pharmaceutical Co. Ltd.
G. H. Heath & Son (1952) Ltd.
S. H. Johnson & Co. Ltd.
Carl Schleicher & Schüll.
The Sugar Manufacturers' Supply Co. Ltd.

Flanges.
Kirk & Co. (Tubes) Ltd. (*Steel, Stainless Steel*)
Talbot Stead Tube Co. Ltd. (*stainless steel*)

Flowmeters.
Evershed & Vignoles Ltd.
Fischer & Porter Ltd.
Lea Recorder Co. Ltd.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Controls Ltd.
John Thompson Instrument Co. Ltd.
Wright Rain Ltd. (*Irrigation*).
Wright Rain Africa (Pvt.) Ltd. (*Irrigation*).

Friction materials (Industrial).
Johns-Manville International Corp.

Fullers' earth.
The Fullers' Earth Union Ltd

Fungicides.
Fisons Pest Control Ltd.

Gearing, *see* Reduction gears.

Gearmotors.
David Brown Industries Ltd., Coventry Gear Divn.
Crofts (Engineers) Ltd.
Hinz Elektromaschinen und Apparatebau.

Grabs, Cane and Beet.
Walkers Ltd.
Joseph Westwood & Co. Ltd.

Granulators, *see* Dryers.

Heat exchangers, Plate type.
Alfa-Laval.
A.P.V. Co. Ltd., Industrial Engineering Division.
Babcock & Wilcox Ltd.
British Boiler Accessories Ltd.
George Cohen, Sons, & Co. Ltd.

Heat exchangers, Tubular.
A.P.V. Co. Ltd., Industrial Engineering Division.
Babcock & Wilcox Ltd.
Blairs Ltd.
British Boiler Accessories Ltd.
George Clark & Sons (Hull Ltd.
George Fletcher & Co. Ltd.
Foster Wheeler Ltd.
Holden & Brooke Ltd.
Kingston Industrial Works Ltd.
Korting Brothers (1917) Ltd.
Lepage, Urbain & Cie.
Salzgitter Maschinen A.G.
S.P.E.I. Chim
John Thompson Water Tube Boilers Ltd.
Walkers Ltd.

Hydraulic controls for valves, etc.
Edwards Engineering Corp.
Duncan Stewart & Co. Ltd.
Walkers Ltd.

Insecticides.
Fisons Pest Control Ltd.

Instruments, Process control.
Beckman Instruments International S.A.
Bellingham & Stanley Ltd.
Belliss & Morcom Ltd.
The British Rototherm Co. Ltd.
Cambridge Instrument Co. Ltd.
Evershed & Vignoles Ltd.
Fischer & Porter Ltd.
Hilger & Watts Ltd.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Controls Ltd.
John Thompson Instrument Co. Ltd.

Insulation, Thermal (heat and cold).
Cape Insulation and Asbestos Products Ltd.
Johns-Manville International Corp.
Lafarge Aluminous Cement Co. Ltd.

Ion exchangers.
W. & R. Balston Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Duper Water Conditioning Cy.
Farnell Carbons Ltd.
IMACTI-Amsterdam.
The Permutit Co. Ltd.
Rohm & Haas Company.
John Thompson-Kennicott Ltd.

Irrigation equipment.
Farrow & Sons Ltd.
Martin-Markham Ltd.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Jointings, *see* Packings and gaskets.

Juice heaters.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Choquenet L. Fonderies et Ateliers.
George Clark & Sons (Hull) Ltd.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.

Juice scales.
George Fletcher & Co. Ltd.
Librawerk.
Richardson Scale Co. Ltd.
N.V. Servo-Balans.
see also Weighing Machines.

Juice strainers and screens.
Ashworth & Parker Ltd.
Blairs Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
George Clark & Sons (Hull) Ltd.
Cocksedge & Co. Ltd.
Dei-Con Eastern Corporation.
Dorr-Oliver Inc., Cane Sugar Divn.
Ferguson Perforating & Wire Co.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
Link-Belt Company.
Mechans Ltd.
The Mirrlees Watson Co. Ltd.
Russell Constructions Ltd.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Walkers Ltd.

Juice and syrup mixers.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Choquenet L. Fonderies et Ateliers.
George Clark & Sons (Hull) Ltd.
Gutehoffnungshütte Sterkrade A.G.
L. A. Mitchell Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd

Knives, Beet.
Köllmann & Gruhn.
H. Putsch & Comp.

Knives, Milling.
Blairs Ltd
BMA Braunschweigische Maschinenbauanstalt.
Broussard Machine Co.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Farrel-Birmingham Co. Inc.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co Ltd.
Stork-Werkspoor N.V. (V.M.F).
Walkers Ltd.

Knives, Milling, Portable grinders.
Flexotube (Liverpool) Ltd.

Laboratory apparatus and equipment.
International Combustion (Export) Ltd.
Karl Kolb.
The Sugar Manufacturers' Supply Co. Ltd.

Electric heating appliances.
Isopad Ltd.
see also Laboratory Instruments *and* Saccharimeters and Polarimeters, *etc.*

Laboratory instruments.
Beckman Instruments International S.A.
Belliss & Morcom Ltd.
The British Rototherm Co. Ltd.
Cambridge Instrument Co. Ltd.
Evershed & Vignoles Ltd.
Fischer & Porter Ltd.
Rotameter Manufacturing Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
John Thompson Instrument Co. Ltd.
Carl Zeiss Jena.
Carl Zeiss, Western Germany.

Refractometers.
Bellingham & Stanley Ltd.
Hilger & Watts Ltd.
Schmidt & Haensch.

Laboratory reagents.
The General Chemical & Pharmaceutical Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Lime density meters.
Rotameter Manufacturing Co. Ltd.

Liming equipment.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
Cocksedge & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
H. Putsch & Comp.
Salzgitter Maschinen A.G.
Stork-Werkspoor N.V. (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Unifloc Ltd.
Walkers Ltd.

Locomotives, Diesel.
Andrew Barclay, Sons & Co. Ltd.
George Cohen, Sons & Co Ltd.
F. C. Hibberd & Co. Ltd.
Robert Hudson Ltd.
Hunslet Engine Co. Ltd.
N.V. Locospoor.
Railway Mine & Plantation Equipment Ltd.
Spoorijzer N.V. Delft.
U.S. Industries Inc. (Great Britain) Ltd.
Walkers Ltd.

Magnetic separators.
Electromagnets Ltd.
Permag Ltd.
Rapid Magnetic Ltd.
Unifloc Ltd.

Massecuite heat treating equipment.
Blairs Ltd.
George Fletcher & Co. Ltd.
The Mirrlees Watson Co. Ltd.
Pott, Cassels & Williamson Ltd
A. & W. Smith & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.
The Western States Machine Co (*Stevens System*).

Mechanical crop thinning machines.
S.K.H. & Son (Salopian–Kenneth Hudson & Son).

Metal detectors.
Metal Detection Ltd.

Mill hydraulics.
Edwards Engineering Corp.
The Mirrlees Watson Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.

Mill rolls.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
G. M. Hay & Co. Ltd.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.

Mill roll movement indicators and recorders.
Edwards Engineering Corp.
Walkers Ltd.

Milling plant.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
David Brown Industries, Ltd., General Gear Division.
David Brown Industries Ltd., Jackson Division.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Farrel-Birmingham Co. Inc.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
G. M. Hay & Co. Ltd.

Milling Plant—*continued*
Honolulu Iron Works Co.
International Combustion (Export) Ltd.
Kek Ltd.
The Mirrlees Watson Co. Ltd
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.).
Technoexport Czechoslovakia.
Walkers Ltd.
see also Knives, Milling *and* Shredders.

Mineral trace elements.
Fisons Pest Control Ltd.

Molasses tanks.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
George Clark & Sons (Hull) Ltd
Kingston Industrial Works Ltd.
Mechans Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.

Nematocides.
Fisons Pest Control Ltd.

Packeting machinery.
Brecknell, Dolman & Rogers Ltd
Chambon Ltd.
Fr. Hesser Maschinenfabrik A.G
Richard Simon & Sons Ltd.
SIG Swiss Industrial Company.

Packings and gaskets.
Cape Insulation and Asbestos Products Ltd.
Johns-Manville International Corp.

Pans, Vacuum.
A.P.V. Co. Ltd., Industrial Engineering Dept.
Bennett, Sons & Shears Ltd.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
George Clark & Sons (Hull) Ltd.
George Cohen, Sons & Co. Ltd.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
Mechans Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Technoexport Czechoslovakia.
John Thompson (Dudley) Ltd.
Walkers Ltd.

Paper and board from bagasse.
Cellulose Development Corp. Ltd.
Lyddon & Co. Ltd.

Parcelling machines.
Fr. Hesser Maschinenfabrik A.G.

Pipes, Steam.
Kirk & Co. (Tubes) Ltd.
Duncan Stewart & Co. Ltd.
Talbot Stead Tube Co. Ltd.

Pipe fittings.
see Tube Fittings.

Ploughs—Disc.
David Brown Tractors Ltd.
Martin-Markham Ltd.
Ransomes Sims & Jefferies Ltd.
S.K.H. & Son (Salopian–Kenneth Hudson & Son).

Ploughs—Reversible.
Ransomes, Sims & Jefferies Ltd.
S.K.H. & Son (Salopian—Kenneth Hudson & Son)

Ploughs—Share.
David Brown Tractors Ltd.
Ransomes Sims & Jefferies Ltd.

Polythene bag sealers.
The Thames Packaging Equipment Co. Ltd.

Power transmission equipment.
Chain Belt Company.
Crofts (Engineers) Ltd.
Farrel-Birmingham Co. Inc.
Heenan & Froude Ltd.
William Kenyon & Sons Ltd.
Renold Chains Ltd.

Preliming equipment.
A/S De danske Sukkerfabrikker.

Presses, Hydraulic.
Tangyes Ltd.

Pressure gauges.
The British Rototherm Co. Ltd.

Printing Machinery—Rotary multi-colour for sugar cartons and bags, etc.
Chambon Ltd.
Fr. Hesser Maschinenfabrik A.G.

Pulverizers, Sugar.
George Cohen, Sons & Co. Ltd.
Gruendler Crusher & Pulverizer Co.
Kek Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Walkers Ltd.

Pumps.
BMA Braunschweigische Maschinenbauanstalt.
Cellulose Development Corp. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
The Harland Engineering Co. Ltd.
Holden & Brooke Ltd.
International Combustion (Export) Ltd.
The Mirrlees Watson Co. Ltd.
Sigmund Pumps Ltd.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
Tangyes Ltd.
Worthington-Simpson Ltd.

Boiler Feed pumps.
The Permutit Co. Ltd.
Saunders Valve Co. Ltd.

Centrifugal pumps.
Saunders Valve Co. Ltd.

Corrosion-proof pumps.
A.P.V. Co. Ltd., Industrial Engineering Dept.
L. A. Mitchell Ltd.
Mono Pumps Ltd.
Saunders Valve Co. Ltd.

Gear pumps.
David Brown Industries Ltd., General Gear Divn.

Irrigation pumps.
Farrow & Sons Ltd.
Martin-Markham Ltd.
Wright Rain Ltd.
Wright Rain Africa (Pvt.) Ltd.

Molasses pumps.
Comet Pump & Engineering Co. Ltd.
Mono Pumps Ltd.

Positive-action pumps.
Comet Pump & Engineering Co. Ltd.
Mono Pumps Ltd.
Progress Engineers Ltd.

Rotary pumps.
Comet Pump & Engineering Co. Ltd.
Mono Pumps Ltd.
Machinefabriek Reineveld N.V

Self-priming pumps.
Chain Belt Company.
Comet Pump & Engineering Co. Ltd.
Mono Pumps Ltd.
Progress Engineers Ltd.
Saunders Valve Co. Ltd.

Sump pumps.
Saunders Valve Co. Ltd.

Vacuum pumps.
see Vacuum pumps.

Railway, *see* Locomotives *and* Track.

Reduction gears.
David Brown Industries Ltd., General Gear Division.
David Brown Industries Ltd., Radicon Divn.
Maschinenfabrik Buckau R. Wolf A.G.
Crofts (Engineers) Ltd.
Farrel-Birmingham Co. Inc.
William Gardner & Sons (Gloucester) Ltd.
The Power Plant Co. Ltd.
Progress Engineers Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
John Thompson Ordnance Co.
Walkers Ltd.

Refinery equipment.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
Honolulu Iron Works Co.
Mechans Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stordy Engineering Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Suchar Sales Corporation
Technoexport Czechoslovakia.

Refractory bricks.
General Refractories Ltd.
Johns-Manville International Corp.
John G. Stein & Co. Ltd.

Refractory cement.
General Refractories Ltd.
Johns-Manville International Corp.
Lafarge Aluminous Cement Co. Ltd.
John G. Stein & Co. Ltd.

Refractory concretes.
General Refractories Ltd.
John G. Stein & Co. Ltd.

Rotary hoes.
Martin-Markham Ltd.

Rubber belt cane carriers.
Farrel-Birmingham Co. Inc.

Saccharimeters and polarimeters.
Bellingham & Stanley Ltd.
Hilger & Watts Ltd.
Schmidt & Haensch.
The Sugar Manufacturers' Supply Co. Ltd.
Carl Zeiss Jena.
Carl Zeiss, Western Germany.

Sack closing machines.
Thomas C. Keay Ltd.
The Sack Filling & Sewing Machine Syndicate Ltd.

Sack filling machines.
Brecknell, Dolman & Rogers Ltd.
Librawerk.
Richardson Scale Co. Ltd.
Richard Simon & Sons Ltd.
The Thames Packaging Equipment Co. Ltd. (*portable*).

Sack printing machines.
Thomas C. Keay Ltd.

Sampling equipment.
Birtley Engineering Ltd.

Scale removal and prevention.
Fisons Pest Control Ltd.
Flexible Drives (Gilmans) Ltd.
Flexotube (Liverpool) Ltd.
The Kleen-e-ze Brush Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
see also Tube Cleaners.

Screens, Centrifegal, *see* Centrifugal Screens.

Screens, Vibrating.
Büttner-Werke A.G.
Chain Belt Company.
Cocksedge & Co. Ltd.
Dei-Con Eastern Corporation.
Electromagnets Ltd.
William Gardner & Sons (Gloucester) Ltd.
Gutehoffnungshütte Sterkrade A.G.
Hein, Lehmann & Co. A.G.
International Combustion (Export) Ltd.
Multi-Metal Wire Cloth Co. Inc.
Russell Constructions Ltd.
Spencer (Melksham) Ltd.
Duncan Stewart & Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Tiss-Metal.
Unifloc Ltd.
Walkers Ltd.
see also Juice Strainers and Screens.

Self-cleaning strainers.
Ashworth & Parker Ltd.

Ship loading installations.
Buhler Brothers.
Simon Handling Engineers Ltd.
Spencer (Melksham) Ltd.

Shredders.
BMA Braunschweigische Maschinenbauanstalt.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gruendler Crusher & Pulverizer Co.
Gutehoffnungshütte Sterkrade A.G.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.

Silos—Pre-stressed concrete.
A/S De danske Sukkerfabrikker.

Skip hoists.
Babcock & Wilcox Ltd.
International Combustion (Export) Ltd.
Marco Conveyor & Engineering Co. Ltd.
New Conveyor Co. Ltd.
Spencer (Melksham) Ltd.
Strachan & Henshaw Ltd.

Spectrophotometers.
Beckman Instruments International S.A.
Hilger & Watts Ltd.
Carl Zeiss Jena.
Carl Zeiss, Western Germany.

Spray chemicals.
Fisons Pest Control Ltd.

Spray nozzles.
Chain Belt Company.
Dei-Con Eastern Corporation.

Steam accumulators.
British Boiler Accessories Ltd.
Cochran & Co., Annan, Ltd.
Duncan Stewart & Co. Ltd.
The Sugar Manufacturers' Supply Co. Ltd.

Steam jet ejectors.
Korting Brothers (1917) Ltd.

Steam storage equipment.
see Steam accumulators.

Steam superheaters.
Babcock & Wilcox Ltd.
Maschinenfabrik Buckau R. Wolf A.G.
Foster Wheeler Ltd.
John Thompson Water Tube Boilers Ltd.

Steam traps.
von Arnim'sche Werke G.m.b.H.

Steam turbines for mill drives, etc.
Belliss & Morcom Ltd.
George Cohen, Sons & Co. Ltd.
A. F. Craig & Co. Ltd.
Escher Wyss Ltd.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G.
The Mirrlees Watson Co. Ltd.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork Werkspoor N.V. (V.M.F.)

Steel.
George Cohen, Sons & Co. Ltd.

Steel bar and wire.
Talbot Stead Tube Co. Ltd.

Stokers—Bagasse burning spreader type.
Babcock & Wilcox Ltd.

factory design and erection (Cane and Beet).
A. F. Craig & Co. Ltd.
Honolulu Iron Works Co.
Salzgitter Industriebau G.m.b.H.
Stork-Werkspoor N.V. (V.M.F.)

Sugar machinery, General.
Blairs Ltd.
BMA Braunschweigische Maschinenbauanstalt.
Maschinenfabrik Buckau R. Wolf A.G.
A. F. Craig & Co. Ltd.
Dorr-Oliver Inc., Cane Sugar Divn.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Gutehoffnungshütte Sterkrade A.G
Honolulu Iron Works Co.
Kingston Industrial Works Ltd.
The Mirrlees Watson Co. Ltd.
Salzgitter Maschinen A.G.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.).
Technoexport Czechoslovakia.
Walkers Ltd.

Sugar throwers and trimmers.
Buhler Brothers.
Cocksedge & Co. Ltd.
Kingston Industrial Works Ltd.
Spencer (Melksham) Ltd.
Stephens-Adamson Mfg. Co.

Switchgear.
Heemaf N.V.

Temperature recorders and controllers.
The British Rototherm Co. Ltd.
Cambridge Instrument Co. Ltd.
Evershed & Vignoles Ltd.
The Sugar Manufacturers' Supply Co. Ltd.
Taylor Controls Ltd.
John Thompson Instrument Co. Ltd.

Thermometers.
The British Rototherm Co. Ltd.
Cambridge Instrument Co. Ltd.
Taylor Controls Ltd.

Track and track accessories.
Robert Hudson Ltd.
N.V. Locospoor.
Railway Mine & Plantation Equipment Ltd.
Spoorijzer N.V. Delft.
U.S. Industries Inc. (Great Britain) Ltd.

Tractors.
David Brown Tractors Ltd.

Trailers.
Cary Iron Works.
Martin-Markham Ltd.
Spoorijzer N.V. Delft.

Tubes, Bi-metal.
Talbot Stead Tube Co. Ltd
Yorkshire Imperial Metals Ltd.

Tubes for boilers, evaporators, juice heaters, vacuum pans, etc.
Babcock & Wilcox Ltd.
Hudson & Wright Ltd.
Kirk & Co. (Tubes) Ltd.
Talbot Stead Tube Co. Ltd.
Yorkshire Imperial Metals Ltd.

Tubes, Carbon, alloy and stainless steel.
Kirk & Co. (Tubes) Ltd.
Talbot Stead Tube Co. Ltd.

***Tube cleaners, Manual (Brushes and scrapers).**
Kleen-e-ze Brush Co. Ltd.
Rotatools (U.K.) Ltd.

Tube cleaners, Rotary (Electric and air).
Rotatools (U.K.) Ltd.
see also Scale removal and prevention.

Tube fittings.
A.P.V. Co. Ltd., Industrial Engineering Dept. (*stainless steel*)
Blakey's Boot Protectors Ltd. (*malleable iron*).
Kirk & Co. (Tubes) Ltd. (*malleable iron and stainless steel*)
Talbot Stead Tube Co. Ltd. (*stainless steel*).
Yorkshire Imperial Metals Ltd. (*copper, brass and plastic*).

Tyres.
Firestone International Company.
Firestone Tyre & Rubber Co. Ltd.

Vacuum pans, *see* Pans.

Vacuum pan supersaturation indicators.
Fischer & Porter Ltd.

Vacuum pumps.
Belliss & Morcom Ltd.
Blairs Ltd.
Officine Meccaniche e Fonderie A. Bosco S.p.A.
George Cohen, Sons & Co. Ltd.
Comet Pump & Engineering Co. Ltd.

Vacuum pumps—*continued*
Dorr-Oliver Inc., Cane Sugar Divn.
Soc. Fives Lille-Cail.
George Fletcher & Co. Ltd.
Holden & Brooke L'd.
International Combustion (Export) Ltd.
Korting Brothers (1917) Ltd.
The Mirrlees Watson Co. Ltd.
Ets. Neyrpic.
A. & W. Smith & Co. Ltd.
Duncan Stewart & Co. Ltd.
Stork-Werkspoor N.V. (V.M.F.)
Walkers Ltd.
Worthington-Simpson Ltd.

Valves.
A.P.V. Co. Ltd., Industrial Engineering Dept.
von Arnim'sche Werke G.m.b.H.
David Brown Industries Ltd. Foundries Divn.
George Clark & Sons (Hull) Ltd.
George Cohen, Sons & Co. Ltd
Kirk & Co. (Tubes) Ltd.
The Lunkenheimer Company.
Saunders Valve Co. Ltd.
G. & A. E. Slingsby Ltd.
Talbot Stead Tube Co. Ltd.
Taylor Controls Ltd.
Walkers Ltd.
Wynn (Valves) Ltd.

Variable speed controls.
Crofts (Engineers) Ltd.
Heenan & Froude Ltd.
Duncan Stewart & Co. Ltd.

Water cooling towers.
Film Cooling Towers (1925) Ltd.
Foster Wheeler Ltd.
AB. Svenska Fläktfabriken.

Weedkillers.
Fisons Pest Control Ltd.

Weighing machines.
Adequate Weighers Ltd.
Chronos Werk, Reuther & Reisert K.G.
Electroweighers (Birmingham) Ltd.
Greif-Werk Maschinenfabrik.
Fr. Hesser Maschinenfabrik A.G.
Librawerk.
Richardson Scale Co. Ltd.
N.V. Servo-Balans.
Richard Simon & Sons Ltd.
Stork-Werkspoor N.V. (V.M.F.)
The Sugar Manufacturers' Supply Co. Ltd.
see also Juice Scales.

Wire brushes, Rotary and manual.
Rotatools (U.K.) Ltd.

Wire cloth.
Ferguson Perforating & Wire Company.
Fontaine & Co.
Multi-Metal Wire Cloth Co. Inc.
Tiss-Metal.
Uniflee Ltd.

Wrapping machines.
Fr. Hesser Maschinenfabrik A.G.
SAPAL.
SIG Swiss Industrial Company.

Yeast plants.
A.P.V. Co. Ltd., Chemical Engineering Division.
BMA Braunschweigische Maschinenbauanstalt.

BUYERS' GUIDE—ADDRESS LIST

Adequate Weighers Ltd.,
Bridge Works, Bridge Road, Sutton, Surrey, England.
Tel.: Vigilant 6666/7/8. *Cable* : Adegrate, London.

Alfa-Laval,
Fleninggatan No. 8, Stockholm, Sweden.

The A.P.V. Co. Ltd.,
Manor Royal, Crawley, Sussex.
Tel. : Crawley 1360. *Cable* : Anaclastic, Crawley.
Telex : 8737

von Arnim'sche Werke G.m.b.H., Werk Schneider & Helmecke,
Offenbach/Main, Germany.
Tel.: Offenbach 82054.
Cable: Kondenstopf, Offenbach/Main.

Ashworth & Parker Ltd.,
Riverside Works, Bury, Lancs., England.
Tel. : Bury 5125–6. *Cable* : Kinetic, Bury.

Associated Chemical Companies (Sales) Ltd.,
P.O. Box 6, Brotherton House, Westgate, Leeds 1, England.
Tel.: Leeds 29321/8. *Cable* : Aschem, Leeds.
Telex : 55–116.

Babcock & Wilcox Ltd.,
Babcock House, 209 Euston Rd., London, N.W.1, England.
Tel.: Euston 4321. *Cable:* Babcock, London.
Telex: 23256.

Andrew Barclay, Sons & Co. Ltd.,
Caledonia Works, Kilmarnock, Scotland.
Tel.: 1366/7 *Cable:* Barclayson, Kilmarnock.

W. & R. Balston Ltd.,
see H. Reeve Angel & Co. Ltd.

Beckman Instruments International S.A.,
rue des Pierres-du-Niton 17, Geneva, Switzerland.
Tel.: 35 64 80. *Cable:* Beckmanint, Geneva.
Telex: Geneva 22596.

Bellingham & Stanley Ltd.,
71 Hornsey Rise, London, N.19, England.
Tel. : Archway 2270. *Cable* : Polyfract, London.

Belliss & Morcom Ltd.,
Ledsam Street Works, Birmingham 16, England.
Tel. : Edgbaston 3531. *Cable* : Belliss, Birmingham 16.

Bennett, Sons & Shears Ltd.,
Pepper Road, Leeds 10, Yorkshire, England.
Tel.: Leeds 73411. *Cable:* Non-Ferrous, Leeds.

F. W. Berk & Co. Ltd.,
Berk House, 8 Baker Street, London, W.1.
Tel. : Hunter 6688. *Cable* : Berk, London.
Telex: 23796.

Birtley Engineering Ltd.,
Birtley, Co. Durham, England.
Tel.: Birtley 248/9. *Cable:* Birtley, Newcastle-on-Tyne.

Blairs Ltd.,
Glasgow Engineering Works, Woodville Street, Govan, Glasgow, S.W.1, Scotland.
Tel. : Govan 1261 *Cable* : Blazon, Glasgow.

Blakey's Boot Protectors Ltd.,
see Pennine Chainbelt Co. Ltd.

BMA Braunschweigische Maschinenbauanstalt.
(20b) Braunschweig, Bahnhofstrasse 5, Germany.
Tel. : Braunschweig 23691. *Cable* : Bema, Braunschweig.
Telex : Bema Bswg. 0952840

Officine Meccaniche e Fonderie A. Bosco S.p.A.,
Terni, Italy.
Tel.: 21. 131-23. 103-38. 173-41. 185. *Cable:* Bosco, Terni.

Brecknell, Dolman & Rogers Ltd.,
Pennywell Road, Bristol 5, England.
Tel.: Bristol 58222. *Cable:* Bremaners, Bristol.

British Boiler Accessories Ltd.
62/63 Fenchurch Street, London E.C.3., England.
Tel.: Royal 4122/6305. *Cable* : Boileracs, London.

The British Rototherm Co. Ltd.,
Merton Abbey, London S.W.19, England.
Tel.: Liberty 7661. *Cable:* Rototherm, London.

Thomas Broadbent & Sons Ltd.,
Central Ironworks, Huddersfield, England.
Tel : Huddersfield 5520. *Cable* : Broadbent, Huddersfield.

Broussard Machine Company,
see Logan Perkins.

David Brown Corporation (Sales) Ltd.,
96/97 Piccadilly, London, W.1, England.
Tel. : Grosvenor 7747. *Cable* : Davibron, London

David Brown Industries Ltd., Coventry Gear Division,
see David Brown Corporation (Sales) Ltd.

David Brown Industries Ltd., Foundries Division,
see David Brown Corporation (Sales) Ltd.

David Brown Industries Ltd., General Gear Division,
see David Brown Corporation (Sales) Ltd.

David Brown Industries Ltd., Jackson Division,
see David Brown Corporation (Sales) Ltd.

David Brown Industries Ltd., Radicon Division,
see David Brown Corporation (Sales) Ltd.

David Brown Tractors Ltd.
see David Brown Corporation (Sales) Ltd.

Maschinenfabrik Buckau R. Wolf A.G.,
Grevenbroich/Ndrrh., Germany.
Tel. : Grevenbroich 1481.
Cable : Maschinenbau, Grevenbroich.
Telex : 08517111.

Buell Ltd.,
3 St. James's Square, London, S.W.1, England.
Tel. : Trafalgar 2528. *Cable* : Allentare, London.

Buhler Brothers,
Uzwil, Switzerland.
Tel.: 5 62 12 Uzwil *Cable* · Buhler, Uzwil.
Telex : 57202

Büttner-Werke A.G.,
Postfach 59, Krefeld-Uerdingen 1, Germany.
Tel.: Krefeld 43511. *Cable:* Büttner, Krefeld-Uerdingen.

Buttner Works Inc.
52 Vanderbilt Avenue, New York 17, N.Y., U.S.A.
Tel.: Murray Hill 9–5098. *Cable* : Buttnerusa, New York.

Buttner Works (Canada) Ltd.,
P.O. Box 688, Montreal, Quebec, Canada.
Tel.: RE-7-9053 *Cable* : Buttner, Montreal.

Cambridge Instrument Co. Ltd.,
13 Grosvenor Place, London S.W.1., England.
Tel.: Belgravia 5066. *Cable* : Unipivot, London·

Cape Insulation and Asbestos Products Ltd.,
114 & 116 Park Street, London, W.1., England.
Tel.: Grosvenor 6022. *Cable:* Incorrupt,London.
Telex : 23759.

Cary Iron Works,
see Logan Perkins.

Catchpole Engineering Co. Ltd.,
78 Risbygate Street, Bury St. Edmunds, Suffolk, England.
Tel.: Bury St. Edmunds 2591.
Cable: Beslift, Bury St. Edmunds

Cellulose Development Corporation Ltd.,
Hatch End, Middlesex.
Tel.: Hatch End 2261. *Cable :* Celdecor, Pinner.

Chain Belt Company,
4701 West Greenfield Avenue, Milwaukee 1, Wisconsin, U.S.A.
Tel.: Evergreen 4-3000. *Cable:* Beltchain, Milwaukee.

Chambon Ltd.,
Riverside Works, Standish Road, London W.6., England.
Tel.: Riverside 6086. *Cable:* Chambonted, London.

Choquenet L. Fonderies et Ateliers—Sté. Ame,
Chauny (Aisne), France.
Tel. Chauny 34.

Chronos Werk, Reuther & Reisert K.G.,
Hennef-Sieg (Rhld), Germany.
Tel.: Sa. Nr. 2381/83. *Cable :* Chronos, Hennefsieg.
Telex : 8/869224

George Clark & Sons (Hull) Ltd.,
Hawthorn Avenue, Hull, England.
Tel.. Hull 37654. *Cable:* Clark, Hull.

The Clydesdale Chemical Co. Ltd.,
105 Millerston Street, Glasgow, E.1, Scotland.
Tel. : Bridgeton 4374. *Cable :* Cactus, Glasgow

Cochran & Co., Annan, Ltd.,
Annan, Dumfriesshire, Scotland.
Tel: Annan 111. *Cable* : Multitube, Annan.

Cocksedge & Co. Ltd.,
Grey Friars Road, Ipswich, Suffolk, England.
Tel.: Ipswich 56161. *Cable:* Cocksedge, Ipswich.

George Cohen, Sons & Co. Ltd.,
58 Wood Lane, London, W.12, England.
Tel. : Shepherds Bush 2070. *Cable :* Omniplant, London.
Telex : 21288/9.

Comet Pump & Engineering Co. Ltd.,
Johnson Road, West Croydon, Surrey, England.
Tel. : Thornton Heath 3816. *Cable :* Comet, Croydon.

Cotton Bros. (Longton) Ltd.,
Crown Works, Portland Road, Longton, Stoke-on-Trent, Staffs., England.
Tel.: Longton 33021. *Cable:* Cotbro, Stoke-on-Trent.

A. F. Craig & Co. Ltd.,
Caledonia Engineering Works, Paisley, Scotland.
Tel. : Paisley 2191. *Cable :* Craig, Paisley.

Crofts (Engineers) Ltd.,
Thornbury, Bradford 3, Yorkshire, England.
Tel. : Bradford 65251. *Cable :* Crofters, Bradford.
Telex : 51186.

James A. Cuthbertson Ltd.,
Station Road, Biggar, Lanarkshire, Scotland.
Te:l. Biggar 20. *Cable:* Mechadrain, Biggar.

C.Z. Scientific Instruments Ltd.,
12a Golden Square, London W.1., England.
Tel.: Gerrard 4488 *Cable:* Cezet, London.

Dallow Lambert Ltd.,
Thurmaston, Leicester, England.
Tel.: Syston 3333. *Cable:* Dust, Leicester.

A/S De danske Sukkerfabrikker,
Langebrogade 5, Kobenhavn K.
Tel.: Central 9030. *Cable:* Sukkerfabrikker, Copenhagen.
Telex : 5530 Sukker KH.

Degenhardt & Co. Ltd.,
6 Cavendish Square, London W.1., England.
Tel.: Langham 6097/9.

Dei-Con Eastern Corporation,
Eastern Hemisphere Export Sales Divn., The Deister Concentrator Co. Inc.,
60 Beaver St., New York 4, N.Y., U.S.A.
Tel.: Digby 4-7389. *Cable :* Retsied, New York.

Dicalite Department, Great Lakes Carbon Corp.,
18 East 48th Street, New York 17, N.Y., U.S.A.
Tel. : Eldorado 5-6200. *Cable :* Dicalite, New York.

Dorr-Oliver Inc., Cane Sugar Division,
Stamford, Conn., U.S.A.

Dunford & Elliott Process Engineering Ltd.,
Linford Street, London, S.W.8, England.
Tel. : Macaulay 2405. *Cable :* Lindaresco, London.

Duper Water Conditioning Company,
Nieuwendammerkade 1-3, Amsterdam-Noord, Holland.
Tel.: 020-60821. *Cable :* Waterduper/Amsterdam.
Telex : 14278.

Edwards Engineering Corp.,
1170 Constance Street, New Orleans 13, La., U.S.A.
Tel.: 524-0175. *Cable:* Joedco, New Orleans.

Eimco (Great Britain) Ltd.,
Earlsway, Team Valley, Gateshead 11, England.
Tel. : Low Fell 7-7241. *Cable :* Eimco, Gateshead.

Electromagnets Ltd.,
Boxmag Works, Bond St., Hockley, Birmingham, England.
Tel.: Central 5391-3. *Cable:* Boxmag, Birmingham.

Electroweighers (Birmingham) Ltd.,
Moseley St., Birmingham 12, England.
Tel.: Victoria 2223 *Cable.:* Elecweigh, Birmingham.

Escher Wyss Ltd.,
Terminal House, 52 Grosvenor Gardens, London, S.W.1, England.
Tel. : Sloane 8101. *Cable :* Escherwyss, London.

Evershed & Vignoles Ltd.,
Chiswick, London, W.4, England.
Tel. : Chiswick 3670. *Cable :* Megger, London.
Telex : 22-583.

Ewart Chainbelt Co. Ltd.,
Colombo Street, Derby, England.
Tel. : Derby 45451. *Cable :* Chainbelt, Derby.

Extraction Continue De Smet S.A.,
38, Avenue de France, Anvers, Belgium.
Tel.: 32.43.05; 32.43.15. *Cable:* Extraxsmet, Anvers.

Farnell Carbons Ltd.,
Conduit Road, Plumstead, London, S.E.18, England.
Tel : Woolwich 1158. *Cable :* Scofar, London.

Farrel-Birmingham Co. Inc.,
Ansonia, Conn., U.S.A.
Tel.: Regent 4-3331.

Farrow & Sons Ltd.,
Spalding, Lincs., England.
Tel.: Spalding 3764. *Cable:* Farrows, Spalding.

Ferguson Perforating & Wire Co.,
130–140 Ernest Street, Providence, R.I., U.S.A.
Tel. : Williams 1–8876. *Cable :* Ferguson, Providence.

Film Cooling Towers (1925) Ltd.,
Chancery House, Parkshot, Richmond, Surrey, England.
Tel.: Richmond 6494/8. *Cable:* Aloof, Richmond.

Filtres Philippe S.A.,
P.O. Box 30, 109 Bld. Henri-Barbusse, Houilles (S. & O.), France.
Tel.: 961-79-90. *Cable:* Alfilipe, Houilles.

Firestone International Company,
1200 Firestone Parkway, Akron, Ohio, U.S.A.
Tel.: Hemlock 4-1671 *Cable :* Firestone, Akron.

Firestone Tyre & Rubber Co. Ltd.,
Brentford, Middlesex.
Tel.: ISLeworth 4141. *Cable :* Firestone, Brentford.

Fischer & Porter Ltd.,
Salterbeck Trading Estate, Workington, Cumberland.
Tel.: Harrington 333 *Cable :* Saltfisch, Workington.

Fisons Pest Control Ltd.,
95, Wigmore Street, London W.1.
Tel.: Welbeck 5500

Société de Fives Lille-Cail,
7 Rue Montalivet, Paris 7e, France.
Tel.: Anjou 22–01. *Cable:* Fivcail, Paris.

George Fletcher & Co. Ltd.,
Masson Works, Litchurch Lane, Derby, England.
Tel. : Derby 45817. *Cable :* Amarilla, Derby.

Flexible Drives (Gilmans) Ltd.,
Skatoskalo Works, Millers Road, Warwick, England.
Tel.: Warwick 448. *Cable:* Skatoskalo, Warwick.

Flexotube (Liverpool) Ltd.,
25, Hope Street, Liverpool 1, England.
Tel.: Royal 3345. *Cable :* Flexotube, Liverpool.

Fontaine & Co.,
Aachen, Germany.

T. B. Ford Ltd.,
30 New Bridge Street, London E.C.4., England.
Tel.: City 2272. *Cable :* Fordfilt, London.

Foster Wheeler Ltd.,
3 Ixworth Place, London, S.W.3, England.
Tel. : Kensington 6363. *Cable :* Rewop, London.
Telex : London 23442.

The Fullers' Earth Union Ltd.,
Patteson Court, Nutfield Road, Redhill, Surrey, England.
Tel.: Redhill 3521. *Cable:* Fullion, Redhill.

William Gardner & Sons (Gloucester) Ltd.,
Bristol Road, Gloucester, England.
Tel.: Gloucester 21261. *Cable:* Gardner, Gloucester.

The General Chemical & Pharmaceutical Co. Ltd.,
Judex Works, Sudbury, Wembley, Middx., England.
Tel.: Arnold 3883. *Cable:* Chemipharm, Wembley.

General Refractories Ltd.,
Genefax House, Tapton Park Road, Sheffield 10, Yorkshire, England.
Tel.: Sheffield 31113. *Cable:* Genefax, Sheffield.
Telex: 54–128.

Goka N.V. Machine Works,
Postbox 130, Koestraat 2a, Amsterdam C, Holland.
Tel.: 222255/6 *Cable:* Kagodam, Amsterdam.
Telex : 14173

Great Lakes Carbon Corp., *see* Dicalite Department.

E. Green & Son Ltd.,
Economiser Works, Wakefield, England.
Tel. : Wakefield 2706. *Cable :* Economiser, Wakefield.

Greif-Work Maschinenfabrik,
177 Kronsforder Landstr., Lübeck, Germany.
Tel.: 24291. *Cable:* Greifwerk, Lübeck.
Telex: 026895 .

Gruendler Crusher & Pulverizer Co.,
2915 North Market Street, St. Louis 6, Mo., U.S.A.
Tel. : Jefferson 1–1220. *Cable :* Grupulco, St. Louis.

Gutehoffnungshütte Sterkrade A.G.,
Werk Düsseldorf, Düsseldorf, Germany.

Haller & Phillips Ltd.,
14 Wool Exchange, Basinghall St., London E.C.2., England
Tel.: Monarch 9041. *Cable :* Haloid, London.

The Harland Engineering Co. Ltd.,
Harland House, 20 Park Street, London W.1.
Tel.: Grosvenor 1221/3. *Cable:* Rhoemetric, London.
Telex : 22881

G. M. Hay & Co. Ltd.,
Strathclyde Foundry, 42 Fore Street, Whiteinch, Glasgow, W.4, Scotland.
Tel. : Scotstoun 4390. *Cable :* Castiron, Glasgow.

Heath Filtration Ltd.,
Sneyd Mills, Newcastle Street, Burslem, Stoke-on-Trent, Staffs., England.
Tel.: Stoke-on-Trent 84698/87172.

G. H. Heath & Son (1952) Ltd.,
Heathcote and Greenhead Works, Burslem, Stoke-on-Trent, Staffs., England.
Tel.: Stoke-on-Trent 87273/4/5. *Cable:* Durability, Burslem.

Heemaf N.V.,
Postbox 4, Hengelo, Netherlands.
Tel.: 05400–5830 *Cable:* Heemaf, Hengelo.
Telex: 31307.

Heenan & Froude Ltd.,
Worcester, England.
Tel. : Worcester 23461. *Cable :* Heenan, Worcester.

Hein, Lehmann & Co. A.G.,
Abt. Massentrennung, P.O. Box 9107, Düsseldorf, Germany.
Tel.: 70201 *Cable :* Herrmannsieb, Düsseldorf.

Fr. Hesser Maschinenfabrik A.G.
Stuttgart-Bad Cannstatt, Nauheimerstr. 99, Germany.
Tel.: Stuttgart 566141. *Cable:* Hesser, Stuttgart-Bad Cannstatt. *Telex :* 072-2362

F. C. Hibberd & Co. Ltd.,
56 Victoria St., London S.W.1., England.
Tel.: Victoria 9517/8. *Cable :* Planetloco, London.

Hilger & Watts Ltd.,
98 St. Pancras Way, Camden Rd., London, N.W.1, England.
Tel. : Gulliver 5636. *Cable :* Sphericity, London.
Telex : 23852.

Samuel Hill Ltd.,
Lark Mill, Hare Street, Rochdale, Lancashire, England.
Tel. : Rochdale 40221. *Cable :* Filtering, Rochdale.

Hinz Elektromaschinen und Apparatebau,
(20b) Braunschweig, Frankfurter Str. 1a, Germany.
Tel. : Braunschweig 25533/4. *Cable :* Hinzmotoren, Braunschweig.
Telex : 0952753.

Holden & Brooke Ltd.,
Sirius Works, West Gorton, Manchester 12, Lancs., England.
Tel.: Ardwick 3883. *Cable:* Influx, Manchester.

Honolulu Iron Works Co.,
165 Broadway, New York 6, N.Y., U.S.A.
Cable : Honiron, New York

Robert Hudson Ltd.,
Raletrux House, Meadow Lane, Leeds, England.
Tel.: Leeds 20004. *Cable:* Raletrux, Leeds.

Hudson & Wright Ltd.,
Halberton Street, Birmingham 18, England.
Tel.: Smethwick 0675/6. *Cable:* Desac, Birmingham.

Hunslet Engine Co. Ltd.,
125 Jack Lane, Leeds 10, Yorkshire, England.
Tel.: Leeds 32261. *Cable:* Engine, Leeds.

IMACTI, Industrieele Maatschappij Activit N.V.,
Postbus 240c, Amsterdam, Holland.
Tel.: 60153. *Cable:* Activit, Amsterdam.
Telex: 14.278.

International Combustion (Export) Ltd.,
19 Woburn Place, London, W.C.1, England.
Tel.: Terminus 2833. *Cable:* Lopulco, London.

Isopad Ltd.,
Barnet By-Pass, Boreham Wood, Herts., England.
Tel.: Elstree 2817/9. *Cable:* Isopad, Boreham, Wood

Johns-Manville International Corp.,
22 East 40th Street, New York 16, N.Y., U.S.A.
Tel.: Lexington 2–7600. *Cable:* Johnmanvil, New York

S. H. Johnson & Co. Ltd.,
Carpenters Road, Stratford, London, E.15, England.
Tel.: Maryland 7431. *Cable:* Filtrum, London.

Thomas C. Keay Ltd.,
P.O. Box 30, Baltic Street, Dundee, Scotland.
Tel.: Dundee 26031/4 *Cable:* Keay, Dundee.

Kek Ltd.,
Palmerston Street, Ancoats, Manchester 12, England.
Tel.: Ardwick 1104/5. *Cable:* Kekgrind, Manchester 12.

John King & Co. (Leeds) Ltd.,
Garnet Road, Leeds 11, Yorkshire, England.
Tel.: Leeds 75414. *Cable:* Malleable, Leeds.

Kingston Industrial Works Ltd.,
P.O. Box 72, Kingston 11, Jamaica, W.I.
Tel.: Kingston 86121 *Cable:* Industrial, Kingston.

Kirk & Co. (Tubes) Ltd.,
74/82 Paradise Street, London S.E.16, England.
Tel.: Bermondsey 3156/9. *Cable:* Kirflanges, London.

The Kleen-e-ze Brush Co. Ltd.,
Hanham, Bristol, England.
Tel.: Bristol 673027. *Cable:* Kleeneze, Bristol.

Karl Kolb,
P.O. Box 16265, Frankfurt/Main, Germany.
Tel.: 337941. *Cable:* Scientific, Frankfurt/Main.

Köllmann & Gruhn,
Postfach 1480, Wuppertal-Barmen 7, Germany.
Tel.: Wuppertal 64211. *Cable:* Köllmannwerk, Wuppertal.
Telex: 08512–774.

Korting Brothers (1917) Ltd.,
Western Avenue, Sheepbridge Lane, Mansfield, Notts., England.
Tel.: Mansfield 5947. *Cable:* Korting, Mansfield.

Krauss-Maffei-Imperial G.m.b.H. & Co.,
München-Obermenzing, Tannenweg 4, Germany.
Tel.: München 65 996. *Cable:* Imperial, München.
Telex: 052 3277.

Ets Krieg et Zivy,
9 Rue Louis-Lejeune, Montrouge (Seine), France.
Tel.: ALEsia 40–80. *Cable:* Krieg Zivy, Montrouge.

Lafarge Aluminous Cement Co. Ltd.,
73 Brook Street, London, W.1, England.
Tel.: Mayfair 8546. *Cable:* Cimenfondu, London

AB. Landsverk,
Landskrona, Sweden.

Lea Recorder Co. Ltd.
Parliament Mansions, Abbey Orchard Street, London S.W.1.
Tel.: Abbey 4078.

Lepage, Urbain & Cie.,
105 Rue de la Convention, Paris 15e, France.
Tel.: Lecourbe 50–02. *Cable:* Alepage, Paris.

Librawerk,
Vossenkamp 1, Braunschweig, Germany.
Tel.: Sammel-Nr. 30851. *Cable:* Librawerk, Braunschweig.
Telex: 0952866.

Link-Belt Company, Department 1258–ISJL,
2680 Woolworth Building, New York 7, N.Y., U.S.A.
Tel.: Digby 9–4210. *Cable:* Linkbelt, New York.

N.V. Locospoor,
78 Bezuidenhout, The Hague, Holland.
Tel.: 720737. *Cable:* Locospoor, The Hague

The Lunkenheimer Company,
Cincinnati 14, Ohio, U.S.A.
Cable: Lunken, Cincinnati.

LURGI Gesellschaft für Chemotechnik m.b.H.,
Frankfurt/Main, Lurgihaus, Leerbachstrasse 72/84, Germany.
Tel.: 55–06–51. *Cable:* Lurgitechnik, Frankfurt.
Telex: 4 11 108.

Lyddon & Co. Ltd.,
18/19 Savile Row, London, W.1, England.
Tel.: Regent 7321/9. *Cable:* Lyddexpor, London.
Telex: 2–2491

Marco Conveyor & Engineering Co. Ltd.,
Rowin Works, Lynn Road, Leytonstone, London, E.11, England.
Tel.: Leytonstone 2254/5. *Cable:* Engimarco, London.

Martin-Markham Limited.
Lincolnshire Works, Stamford, Lincs.
Tel.: Stamford 2621/4 *Cable:* Marktrac, Stamford.

Mechans Ltd.,
Scotstoun Iron Works, Glasgow W.4, Scotland.
Tel.: Scotstoun 2211. *Cable:* Nautical, Glasgow.
Telex: 77234.

Metal Detection Ltd.,
Moseley Street, Birmingham 12, England.
Tel.: Victoria 0211. *Cable:* Metection, Birmingham.

The Mirrlees Watson Co. Ltd.,
45 Scotland Street, Glasgow, C.5, Scotland.
Tel.: South 2701/4. *Cable:* Mirrlees, Glasgow.

L. A. Mitchell Ltd.,
Harvester House, 37 Peter Street, Manchester 2, England.
Tel.: Blackfriars 7224/7824. *Cable:* Inspection, Manchester.

Mono Pumps Ltd.,
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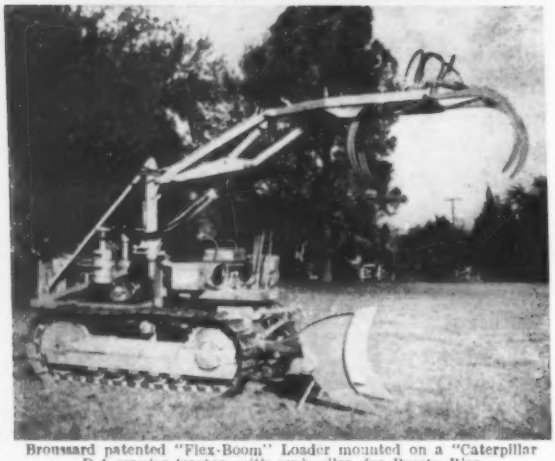

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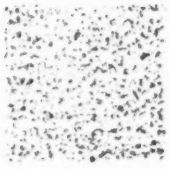

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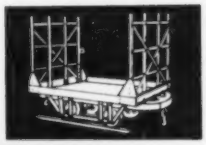

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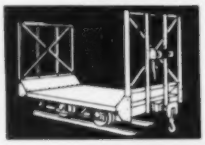

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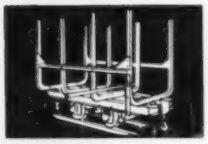

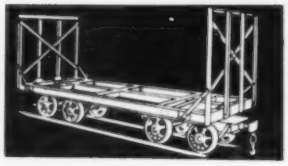

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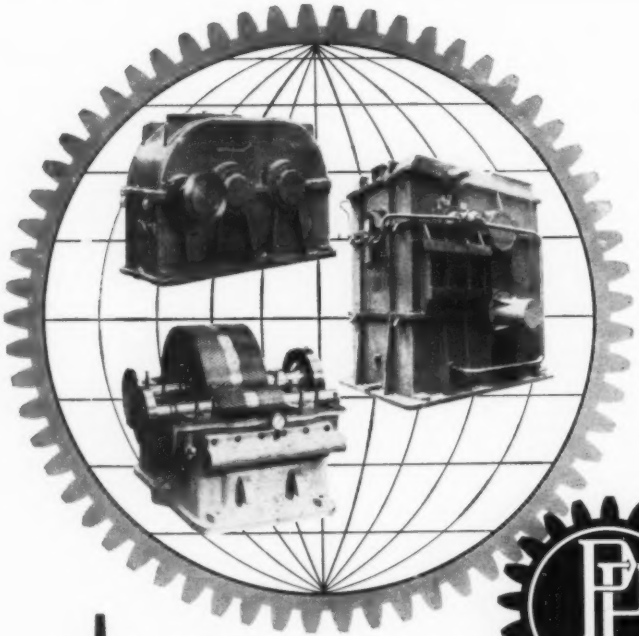

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Foreign Section: Sugar production in U.S. and other countries (beet and cane). Imports and distribution of sugar and by-products in U.S. World demand and consumption, quotas, distribution, transport, etc.

$5 post paid

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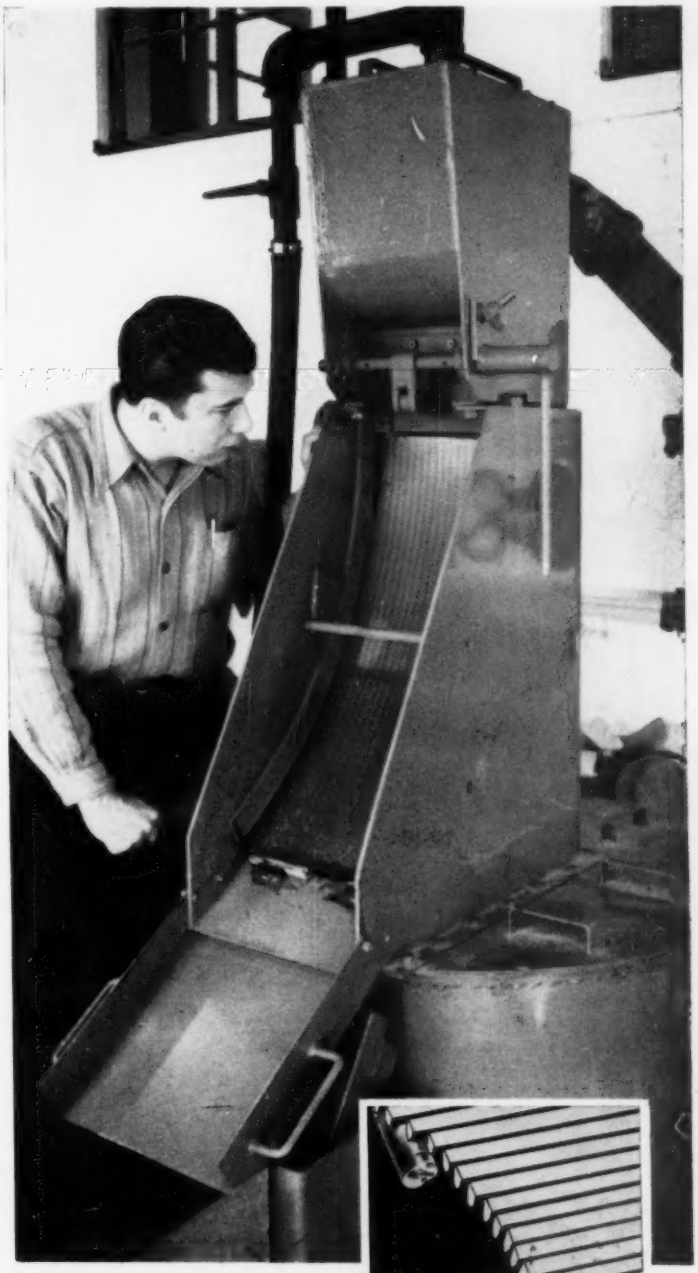
A NEW WAY TO SEPARATE FIBER FROM CANE JUICE...

The DORR-OLIVER DSM® SCREEN

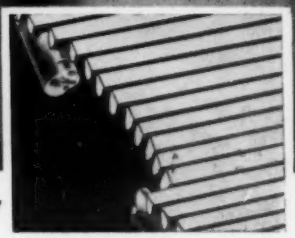
Latest addition to Dorr-Oliver's line of sugar processing equipment is the DSM Screen. A radical departure from normal practice, the DSM offers many advantages over conventional screens. It consists of a stationary housing equipped with a concaved wedge bar type screen with provisions for introducing feed and withdrawing fiber and juice.

In operation, juice enters the feed box and is fed by gravity tangentially onto the upper surface of the screen. Flowing down the concave surface at right angles to the openings between the wedge bars, the juice passes through these apertures and is collected in the screen box. Fibers pass down the screen surface and are dewatered prior to discharge.

For further information on the DSM Screen for separating fiber from cane juice, write to Dorr-Oliver Incorporated, Stamford, Conn., U. S. A.



A DSM Screen installation showing simplicity of design and overall compactness.



Closeup showing detail of wedge bar design.

ADVANTAGES OF THE DORR-OLIVER DSM SCREEN

- Wedge bar design promotes high screening efficiency and essentially a non-blinding screen.
- The DSM is a compact unit which can be installed with a minimum of effort.
- Stationary design with no moving parts means low operating cost and minimum maintenance.

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